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The family Caecidae in the South-West Pacific (Gastropoda: Rissooidea)

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(Fig. 1A-D, Fig. 2C)

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Boss K.J., 1982. Mollusca, in Parker S.P. (ed.), *Synopsis and Classification of Living Organisms*. Vol. 1. McGrow-Hill, New York: 945-1166.
Carter J.G., Campbell D.C. & Campbell M.R. 2000. Cladistic perspectives on early bivalve evolution, in Harper E.M., Taylor J.D. & Crame J.A. (eds), The Evolutionary Biology of the Bivalvia. *Geological Society, London, Special Publications*, **177**: 47-95.
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The family Caecidae in the South-West Pacific (Gastropoda: Rissooidea)

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Abstract

This regional revision of the family Caecidae from the South-West Pacific, is based on material collected during oceanographic expeditions made by the Muséum National d'Histoire Naturelle (Paris) from 1976 to 2006. The material consists of about 8250 specimens from 208 stations. In addition, material from the Australian Museum (Sydney) (94 lots) and the Western Australian Museum (Perth) (42 lots), and other specimens from private collections, were used. In the present work, 43 species are dealt with, belonging to the genera *Caecum* (31), *Meioceras* (4), *Parastrophia* (6) and *Strebloceras* (2). Two genera, *Gladioceras* and *Ctiloceras*, were not dealt with because of the absence of related material. These are the sole genera considered valid on the basis of their distinct type of development. Of these species, 18 are described as new. An extensive usage of type material was done for comparisons, either on directly or by means of photographs. Lectotypes were selected for *Strebloceras cornuoides* Carpenter, 1859†, *C. chinense* Folin, 1868, *C. modestum* Folin, 1868, *C. sepimentum* Folin, 1868, *C. succineum* Folin, 1880, *C. bimarginatum* Carpenter, 1858, *C. inflatum* Folin, 1869, *C. attenuatum* Folin, 1880, *M. legumen* Hedley, 1899, *Parastrophia cornucopiae* (Folin, 1869) and *Strebloceras subannulatum* Folin, 1879.

Key words: Caecidae, systematics, new species, New Caledonia, South-West Pacific.

Riassunto

[La famiglia Caecidae nel Pacifico sud-occidentale (Gastropoda: Rissooidea)]. Questa revisione regionale della famiglia Caecidae nel Pacifico sud-occidentale, è basata sul materiale raccolto durante le spedizioni oceanografiche effettuate dal Muséum National d'Histoire Naturelle (Parigi) dal 1976 al 2006. A questo materiale, proveniente dai dragaggi effettuati in 208 stazioni (circa 8250 esemplari raccolti), è stato aggiunto quello fornito dall'Australian Museum (Sydney) (94 lotti) e dal Western Australian Museum (Perth) (42 lotti), oltre a materiale delle collezioni private degli Autori. Lo studio di questo copioso materiale ci ha permesso di ampliare la conoscenza della famiglia Caecidae nel sud-ovest del Pacifico e di fare confronti con la fauna a Caecidae di altri settori, sia del Pacifico, sia dell'Oceano Indiano. In questo lavoro, sono trattate 43 specie, appartenenti ai generi *Caecum* (31), *Meioceras* (4), *Parastrophia* (6) e *Strebloceras* (2). Questi sono gli unici generi ritenuti validi sulla base dei loro distinti modi di sviluppo. I generi *Gladioceras* e *Ctiloceras* non sono stati considerati a causa dell'assenza di materiale relativo. Su 43 specie, 18 sono descritte come nuove. In questo studio sono stati ampiamente fatti confronti con materiale tipo, sia direttamente, sia su documentazione fotografica. Per le seguenti specie, sono stati selezionati i rispettivi lectotipi: *Strebloceras cornuoides* Carpenter, 1859†, *C. chinense* Folin, 1868, *C. modestum* Folin, 1868, *C. sepimentum* Folin, 1868, *C. succineum* Folin, 1880, *C. bimarginatum* Carpenter, 1858, *C. inflatum* Folin, 1869, *C. attenuatum* Folin, 1880, *M. legumen* Hedley, 1899, *Parastrophia cornucopiae* Folin, 1869 e *Strebloceras subannulatum* Folin, 1879.

Parole chiave: Caecidae, sistematica, nuove specie, Nuova Caledonia, Pacifico sud-occidentale.

Introduction

The family Caecidae Gray, 1850 consists for the most part of molluscs provided with small tubular shells, which are closed at the posterior end by a calcareous formation (septum). It is subdivided into three subfamilies, herein listed. 1) Subfamily Caecinae Gray, 1850: larval shell planispirally coiled, discarded when the mollusc has built a new portion of tube and sealed the posterior end with a septum (**Fig. 7A**); 2) Subfamily Pedumicrinae Iredale & Laseron, 1957: larval shell uncoiled, kept attached to teleoconch all through the lifetime. 3) Subfamily Strebloceratinae Bandel, 1996: larval shell trochospirally coiled, kept attached to teleoconch all through the life-time.

The systematic account of Caecidae has a long and complex history. The first to mention this group, calling it *Dentalium minutum* ("Unrecognizable, but probably a synonym of *Gadila gadus*", Scarabino, 2012), was Linnaeus (1758). Later, Montagu (1803) described three species from the British Isles and placed them in the genus *Dentalium*. It was Fleming (1813) who first understood the unique characteristics of this family, placing them between *Dentalium* and *Serpula*. Brown (1827), unaware of the growth stages of Caecidae, suggested two genera, *Brochus* for the adults and *Cornuoides*† for the juveniles stages, and placed them among the Annelida as belonging to Maldaniae (later emended to Maldanidae), characterized by the presence of gills in the young stages and an opening at both ends of the tube.

Zborzewski (1834), when describing *Caecum trachea*, inserted it into the new genus *Odontina*. In same year, he examined the soft parts of *C. trachea*, but did not publish the results until 1849. Philippi (1836) also described *C. trachea* as *Odontidium rugulosum* (2 syntypes NHMUK 1857.6.4.1529, **Fig. 7C**) including the new genus among the Pteropoda, citing Cantraine (1835). In 1848, Searles-Wood published and illustrated four fossil *Caecum* species from the Coralline Crag and positioned them between *Vermetus* and *Littorina*. He was the first to highlight the importance of the septum as a discriminating character at species level. Forbes & Hanley (1853) described in detail the soft parts of *C. glabrum* in relation to *C. trachea* and placed them among the Turritellidae. In 1855, Clark published a work with a detailed anatomical description, and placed the genus *Caecum* within the family Vermetidae on the basis of a strong similarity between their anatomy.

Caecidae were raised to a family rank for the first time by J.E. Gray (1857), between Rissoadae (*sic*) and Melaniadae in 1857. He also created the genus *Brochina* to include shells with a smooth tube, simple aperture, mammillate septum and convex operculum. Some years later Folin (1875), proved the inconsistency of the genus *Brochina*, in particular focusing on the randomness of the operculum convexity. Carpenter (1857) extensively studied this family, dividing the genus *Caecum* into three main groups, *Elephantulum*, *Anellum* and *Fartulum*, on the basis of shape and size of the tube. Some years after Carpenter's studies, Folin (1868-1869) began a systematic and focused study of Caecidae, theorizing on the process of septum formation and the type of development (1875). His results are still fundamental in the knowledge of this family. More recently, Pizzini et al. (1998) discovered the presence of a temporary septum in many Caecidae, placed over and often rather distinct from the final septum. This character, although still under study, does not imply ontogenetic variation but it leads us to hypothesize a systematic revision of the Caecidae genera in the light of this new character. For the time being, within the subfamily Caecinae, we prefer to use only *Caecum* and *Meioceras*, both considered valid on the basis of their distinct growth's morphologies. A few authors (among them Moolenbeek et al., 1989 and Hoenselaar & Hoensalaar, 1990) tried to study in detail the larval stage of Caecidae, on species where the larval stage can be clearly identified (e.g. *C. trachea* Montagu, 1803 and *C. armoricum* Folin, 1869). Unfortunately, the results were not very comprehensive due to the difficulty in finding the early growth stages still attached together, prerequisite for comparing sculpture and microsculpture of the different shell growth stages.

The family Caecidae is currently placed within Rissoidea Gray, 1847 (Bouchet & Rocroi, 2005). However a recent study based on molecular data indicates that Caecidae should be rather placed within Truncatelloidea Gray, 1840 (Criscione & Ponder, 2013). For the time being, waiting for more comprehensive studies that include representatives of all Caecidae genera, we prefer to maintain the current classification. In the past, excluding rare studies on single species few authors have studied this family in depth, such as Folin (1867 to 1886), Carpenter (1858-1859), Hedley (1899 to 1904) who studied the Caecidae of New Zealand, Vayssière (1930), Iredale and Laseron (1957) who concentrated their attention on the genera *Ctiloceras* Watson, 1886, *Transcopia*, *Torresella*, *Carinocera*, *Jayella* and *Enigmerges* all Iredale & Laseron, 1957, and Bandel (1996) who mainly studied their phylogeny.

The family Caecidae appeared, in the Caenogastropoda evolutionary history, during the Paleogene in New Zealand, dating back to the first Rissooidea with straight uncoiled teleoconchs (Bandel, 1996). From the ancestor Strebloceras† (Finlay, 1931; Bandel, 1996), two distinct groups probably originated, the genera Caecum and Parastrophia placed respectively (Bandel, 1996) in the subfamilies Caecinae and Pedumicrinae, both ranked at family level by Millard (1997).

During the Oligocene, deep changes occurred, especially in the larval stage: while in the Pedumicrinae, the larval stage remains attached to the adult stage, in the Caecinae it is lost after the growth of part of the adult, uncoiled shell, being the apical aperture sealed by a septum (**Fig. 7A, B**).

Two principal kinds of development are present: the planktotrophic and the lecitotrophic (non-planktotrophic), which are easily detected by the higher or lower number of embryonic whorls, respectively.

The supraspecific classification of Caecidae, despite some anatomical and radular studies (e.g. Vayssière, 1930; Götze, 1938; Marcus & Marcus, 1963; Draper, 1979; Hugues, 1985b), is still based on the shell morphology, because to date anatomical and radular data prove to be insufficient to support their systematics at genus and subgenus level.

Material and methods

Although initially the aim of this study of the Caecidae family was to examine the malacofauna of the New Caledonian region, from the Coral Sea to southern Vanuatu, with the addition of extra-material from public and private collections, it later expanded to most of the Indo-Pacific Ocean, becoming the first comprehensive revision of the Caecidae from this wide area (a second one is in progress) and allowing us to trace the first, though incomplete, map of this family in the Indo-Pacific Ocean. The majority of the samples examined comes from New Caledonia (Appendix II, Tab. 1), providing a fairly comprehensive survey of the area. Other material comes from some cruises concerning neighbouring areas (Appendix II, Tabs 2-6). In total, 208 stations and ca. 8250 shells were examined.

Most dredgings were made at great depths, which are incompatible with the occurrence of Caecidae, so few stations provided specimens of this family, excluding Montrouzier Expedition Sept. '93 (New Caledonia, Touho East-coast sector), Montrouzier Expedition Oct.

'93 (New Caledonia, Koumac Sector NW), Atelier Lifou 2000 (Loyalty Islands, Lifou - Santal Bay) and Santo Marine Biodiversity Survey, 2006 (Vanuatu Islands).

All the material has been combined and compared with that supplied by AMS, LACM and WAM coming from a wide area within the Australian seas and some archipelagos of the Central Pacific Ocean, as well as with material used for a revision of the Caecidae of South Africa (in progress). The examined material largely consists of dry specimens and a few in alcohol. In addition, we studied specimens from our own collections, principally yielded from occasional findings in the Red Sea, East Africa coasts and portions of the South-East Asian seas. In all, this material has yielded 44 species of Caecidae, of which 18 are herein described as new.

The shell-morphological analysis we used takes into account the following characters: general shape, sculpture characters, shape of septum, presence/absence and typology of microsculpture on the periostracum, apertural ring, dimensions, presence/absence of a temporary septum (Pizzini et al., 1998), and shape of the operculum (sculpture of inner and/or outer surfaces). Therefore, it was necessary to analyze, one by one, their range of variability (Absalão & Pizzini, 2002), and then compare each specimen with the type material, mainly stored in MNHN, NHMUK, NHMUK, Paleontology Section (U.K.), AMS, NMNS, USNM, ZMB. When the type material was not available, or it was too badly preserved, original or other reliable illustrations were used for comparisons.

The shape of septum has taken on greater importance since Pizzini et al. (1998) demonstrated the existence of a temporary septum, which can be different in its various growth stages. For instance, Lightfoot (1992a, b) created a virtual "Unnamed" subgenus which contained species with a "pointed finger-like" mucro, only visible by removing the temporary septum, usually dome-shaped. As a consequence, one could place a species in two different subgenera, according to the characters of septum or of the hidden septum. Even the sculpture of the tube and the inner surface of the operculum, as pointed out by Absalão & Pizzini (2002), provide unreliable characters. Sculpture may be well developed in young specimens, and lacking in the adult stages. In addition, the inner surface of the operculum may be considered useful only at an infraspecific level, because it has been observed that similar sculptured operculum may be present in species which otherwise have completely different morphological characters.

For the abovementioned reasons, we distance ourselves from the most recent systematics suggested by Bandel (1996), since we think that it is not possible to define an acceptable generic/subgeneric classification based on the current knowledge. Taking a conservative stance, we use the genus Caecum s.l. as a temporary placeholder, awaiting future studies to provide adequate characters for the separation at the supraspecific level (Absalão & Pizzini, 2002). Within this same context we use Meioceras, Parastrophia, Strebloceras, Gladioceras and Ctiloceras, which are the only other genera containing species classified upon consistent and distinct growth morphology, and so avoiding the creation of artificial groups. Gladioceras and Ctiloceras are not discussed in this study, because they were not present in the study material.

About the anatomy of this family, we illustrate the schematic drawing of C. glabrum Montagu, 1803 (Götze, 1938) quoted by Panetta (1980) (**Fig. 7D**), highlighting some internal and external organs visible in the colour photos (**Figs 20, 21**), e.g. motile cilia, eyes, foot, operculum, and fecal pellets inside the abapical side of the tube.

The area dealt with in the present work (**Fig. 1**) includes nearly all of New Caledonia (East, South, South-West and North-West) and Loyalty Islands (**Fig. 2**), Vanuatu Islands (**Fig. 3**), Fiji Islands (**Fig. 4**), Philippines (**Fig. 5**) and Wallis Islands (**Fig. 6**).

All type material of the new species is stored in the MNHN.

The following type material was used for comparisons: *C. amaltheanum* Hedley, 1899, holotype, AMS n.C5692 (**Fig. 15K**); *C. angustum* Folin, 1886, holotype NHMUK 1887.2.9.2364 (**Fig. 13D**); *C. attenuatum* Folin, 1880, 5 syntypes NHMUK 1887.2.9.2315-2319, lectotype herein selected NHMUK 1887.2.9.2315 (**Fig. 9O**) and the paralectotypes NHMUK 1877.2.9.2316-2319; *C. berberense* Ladd, 1972, holotype USNM 650429, paratype USNM 650428 (**Fig. 8H**); *C. bimarginatum* Carpenter, 1858, lectotype NHMUK 1858.12.9.25 (from Singapore, in original description) (**Fig. 14K**); 1 syntype NHMUK 1858.12.9.26 (from Australia); 1 probable syntype NHMUK 1993139 (from East Indies); *C. campanulatum* Raines & Pizzini, 2005, holotype, LACM n. 3027 (**Fig. 11A**); *C. chinense* Folin, 1868, lectotype herein selected MNHN n. 24905 (**Fig. 12L-N**); *C. danielei* Pizzini & Raines, 2011, holotype MNHN n. 22066 (**Fig. 14B**); *C. eburneum* Folin, 1886, original type NHMUK 1887.2.9.2365 (**Fig. 11F-G**); *C. exile* Folin, 1879, holotype NHMUK 1887.2.9.2362 (**Fig. 8J**); *C. gulosum* Hedley, 1899a, holotype, AMS n. C5919 (**Fig. 11J**); *C. heterapex* Habe, 1963, holotype NMNS - Mo 39925 (**Fig. 8P**); *C. hinoidei* Habe, 1978, holotype, NMNS, Mo 55376 (**Fig. 9I**); *C. inflatum* Folin, 1869, lectotype MNHN 24915 (**Fig. 13P-R**); *C. kontiki* Pizzini & Raines, 2011, holotype MNHN 22068 (**Fig. 11M**); *Pictocaecum japonicum* Habe, 1978, holotype NMNS (**Fig. 12E**); *C. maculatum* Habe, 1963, holotype NMNS (**Fig. 8E**); *C. mauritianum* Folin, 1868, holotype MNHN (**Fig. 13I-K**); *C. microcyclos* Folin, 1880, 14 syntypes NHMUK 1887.2.9.2345-2356 (**Fig. 9Q**); *C. modestum* Folin, 1868, lectotype herein selected MNHN n. 24913 (**Fig. 14F**); *C. ryssotitum* Folin, 1867, 3 syntypes NHMUK 1868.2.17.7 (ph) (**Fig. 14L**); *C. sepimentum* Folin, 1868, lectotype herein selected MNHN n. 24907 (**Fig. 8D**); *C. smriglioi* Pizzini, Nofroni & Bonfitto, 2008, holotype MZB (**Fig. 9F**); *C. subflavum* Folin, 1880, syntype NHMUK 1887.2.9.2334 (**Fig. 12J**); *C. succineum* Folin, 1880, lectotype herein selected NHMUK 1887.2.9.2344 (**Fig. 11R**); *C. varanoi* Pizzini, Nofroni & Bonfitto, 2008, holotype AMS C415402 - n. 000384C (**Fig. 9B-C**); *C. vertebrale* Hedley, 1899: holotype AMS n. C5917 (**Fig. 8I**); *M. kajiyamai* Habe, 1963, holotype NMNS (**Fig. 15M**);

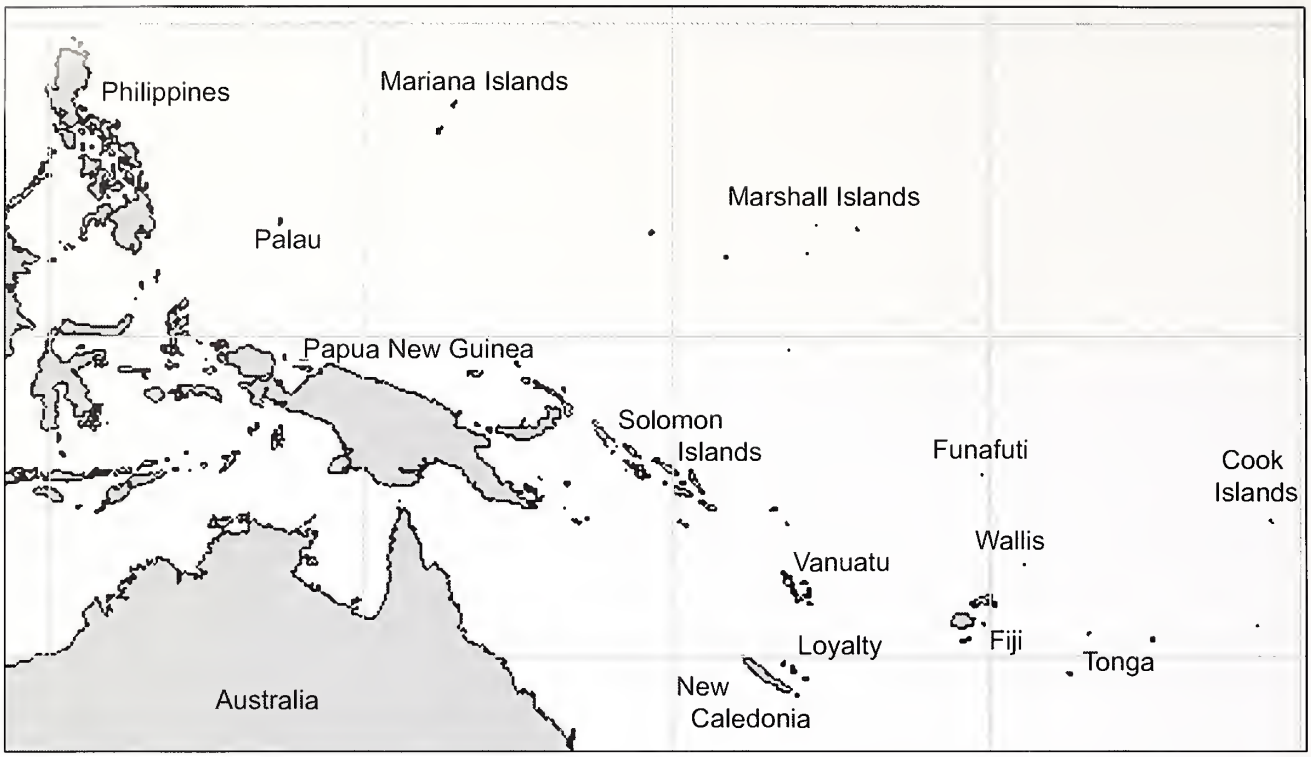


Fig. 1. Map of South West Pacific.

Fig. 1. Mappa del Pacifico Sud-Occidentale.

M. legumen Hedley, 1899, lectotype herein selected AMS C5693c (**Fig. 15H**); *M. sandwichensis* Folin, 1881, holotype MNHN (**Fig. 15G**); *P. challengeri*, holotype NHMUK 1887.2.9.2307, (**Fig. 18D**); *Parastrophia cornucopiae* Folin, 1869, 3 syntypes MNHN (lectotype herein selected MNHN n. 249017, **Fig. 16F-G**); *P. elegans* Folin, 1879, 2 syntypes NHMUK 1887.2.9.2311-13 (**Figs 17K-M, 17P**); *P. filum* Melvill, 1906, holotype NHMUK 1906.10.23.47 (**Fig. 16M, N**); *P. japonica* Hinoide & Habe, 1978, holotype, NMNS-Mo 55474 (**Fig. 16S**) and 2 paratypes NSMT-Mo 55475, 55476; *Strebloceras cygnicollis* Hedley, 1904, holotype AMS n. C. 17960 (**Fig. 18B**); *Strebloceras subannulatum* Folin, 1879, lectotype herein selected NHMUK n. 1887.2.9.2308 (**Fig. 18M-O**); *Strebloceras cornuoides* Carpenter, 1859† (1859:441), figured by Munt & Barker, 1996, lectotype herein selected n. G 72096 NHMUK, Paleontology Section (**Fig. 17R**); *Fartulum magatama* Habe, 1978, holotype NMNS, Mo 55432 destroyed by Byne's disease (Hasegawa, pers. comm.) (**Fig. 15F**); *Micranellum schlangeri* Ladd, 1972†, holotype USNM n. 650430 Early Miocene (**Fig. 15N**); *Spirolidium sumatranum* Thiele, 1925, holotype ZMB/Moll-108515, (**Fig. 16H, I**).

Abbreviations, acronyms and terminology

AMS = Australian Museum, Sydney (Australia); ANSP = Academy of Natural Sciences of Philadelphia, (U.S.A.); CM = Canterbury Museum, Christchurch (New Zealand); LACM = Natural History Museum of Los Angeles County, (U.S.A.); MNHN = Muséum National d'Histoire Naturelle, Paris (France); MZB = Museo di Zoologia dell'Università di Bologna (Italy); NHMUK = Natural History Museum U.K. London (U.K.) formerly NHML; NMSA = KwaZulu-Natal Museum, Pietermaritzburg (South Africa), formerly NM; NMDP = Natal Museum Dredging Programme (South Africa); NMNS = National Museum of Nature and Science, Tokyo (Japan), formerly NSMT; NMNZ = Museum of New Zealand Te Papa Tongarewa, Wellington (New Zealand); SBMNH = Santa Barbara Museum of Natural History, (U.S.A.); SMNH = Swedish Museum Natural History (Sweden); USNM = National Museum of Natural History, Washington, (U.S.A.); WAM = Western Australian Museum, Perth (Australia); WoRMS = World Register of Marine Species; ZMB = Natural History Museum Berlin (Germany); ZSM = Bavarian State Collection of Zoology, Munich (Germany); BR = Bret Raines colln.; DK = David Kirsch colln.; IK = Ingo Kurtz colln.; JL = Jean Letourneux colln.; MP = Mauro Pizzini colln.; RR = Ruggero Ruggeri colln.; Stn = Station; sh = empty shell(s), without soft parts and/or operculum; fms = fathom (ca. 1.83 m); CP = trawl; DR = rock dredge; DW = Warén dredge; lv = live collected specimen(s), with soft parts and/or operculum; ph = type material examined through photographs; dorsal = upper or top (convex) side (from Lightfoot, 1992a); ventral = under or bottom (concave) side (from Lightfoot, 1992a); septum = closure of the shell at the apex or posterior end as it sheds earlier stages (from Lightfoot, 1992a); mucro = small to large prong projecting from septum (from Lightfoot, 1992a); varix (concerning the genus *Caecum*) = thickening or swelling of apertural end, often with sculptural details (from Lightfoot, 1992a); varix (concerning the genus *Parastrophia*) = the ring separating uncoiled portion of protoconch from teleoconch; † = symbol indicating fossil Genus/Species; sinusigera notch = sinus defined by the sinusigera; *s.l.* = *sensu lato*;

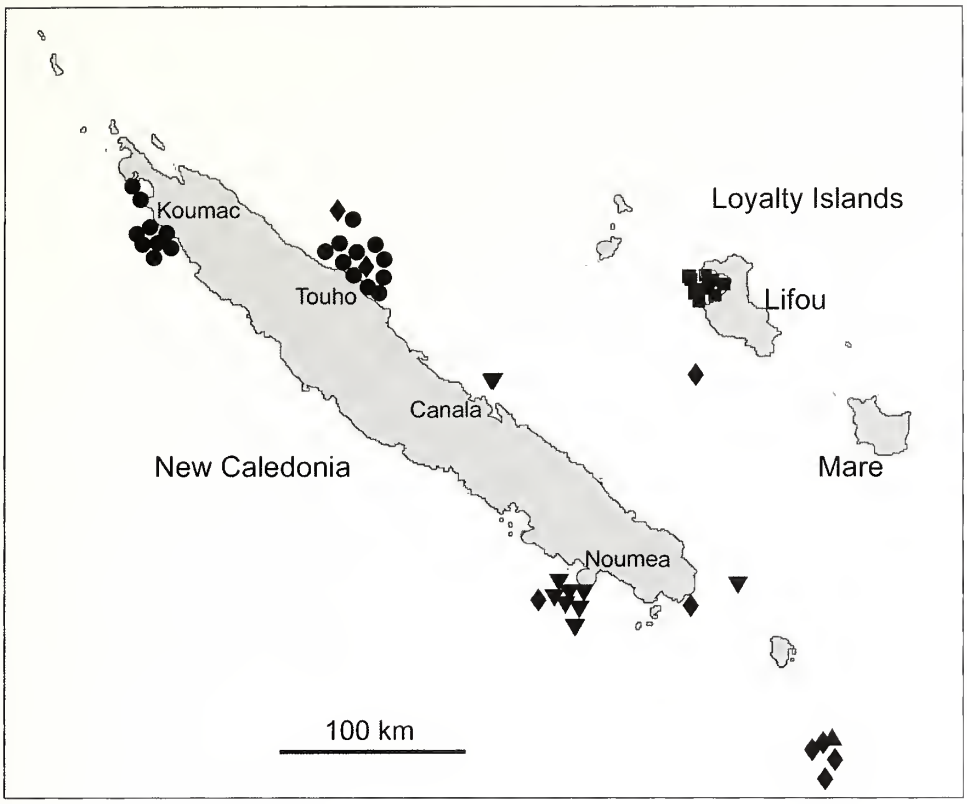


Fig. 2. Selected sampling locations from expeditions to New Caledonia and the Loyalty Islands. ◆ Vauban, 1976, Vauban, 1978/79, Orstom, 1987, Campagne Lagon, 1992; ▼ Smib 8, 1993, Bathus 1, 1993, Bathus 2, 1993, Bathus 3, 1993; ● Montrouzier, 1993; ■ Atelier Lifou, 2000; ▲ Norfolk 1, 2001.

Fig. 2. Località di campionamento selezionate dalle spedizioni in Nuova Caledonia e Isole della Lealtà. ◆ Vauban, 1976, Vauban, 1978/79, Orstom, 1987, Campagna Lagon, 1992; ▼ Smib 8, 1993, Bathus 1, 1993, Bathus 2, 1993, Bathus 3, 1993; ● Montrouzier, 1993; ■ Atelier Lifou, 2000; ▲ Norfolk 1, 2001.

cutting plane = the plane defined by the edge of the shell at the apex (excluding septum and mucro); coiled protoconch = the first portion of the protoconch which is coiled, to distinguish it from the uncoiled second portion of the protoconch. This term will be used especially during the treatment of the genus *Parastrophia*; FIB = Focused Ion Beam.

Systematics

Class Gastropoda Cuvier, 1797
Superfamily Rissooidea Gray J.E., 1847
Family Caecidae Gray J.E., 1850
Subfamily Caecinae Gray J.E., 1850

Genus *Caecum* s.l. Fleming, 1813

Caecum Fleming, 1813: p. 67.
Brochus Brown, 1827: pl. 1.
Odontidium Philippi, 1836: vol. I, p. 102, pl. 6, fig. 20.
Brochina Gray, 1857: p. 101.
Caecum (*Defolinia*) Weisbord, 1962: p. 166, pl. 14, fig. 15.
Pictocaecum Habe, 1978: p. 3, pl. 1, figs 14-17.

Type-species

Dentalium trachea Montagu, 1803 (by subsequent designation, Gray, 1847: p. 203) from Europe.

Diagnosis

Shell minute, with teleoconch consisting of a slightly curved tube, which may be smooth or crossed by collabral rings, axial ribs, and/or in combination. The posterior end of the tube is periodically sealed by a septum. The protoconch is planispirally coiled. There are essentially two kinds of post-embryonic growth types. A species may first begin as a free swimming veliger, which is provided with a shell usually consisting of more than one whorl. However, other species may start out from an egg as crawling young with a shell consisting of only about a whorl. Benthic life begins with the construction of the uncoiled teleoconch. As the mollusc grows, it builds new portions of tube, increasing in size and strength sealing the posterior end with a septum before discarding the previous stage.

Caecum sepimentum Folin, 1868
(Figs 8A-D, 8F, G, 19K, 20A-F)

Caecum sepimentum Folin, 1868c: p. 84, pl. 6, fig. 7.
Caecum sepimentum var. *arcuata* Folin, 1879: p. 809.
? *Caecum lilianum* Hedley, 1902: p. 603, pl. 29, fig. 7.
Caecum maculata Habe, 1963: p. 236, fig. 2.
Caecum berberense Ladd, 1972: pp. 22, 23, pl. 5, figs 11, 12.
Caecum septimentum [*sic*] Lightfoot, 1992b: pp. 3, 4, figs 2, 3.

Type material

C. sepimentum Folin, 1868: 23 syntypes from Mauritius and Réunion Islands on the same glass slide MNHN (Kisch, 1959b); lectotype herein selected MNHN n. 24907 (**Fig. 8D**).

Type locality

Mauritius Is.

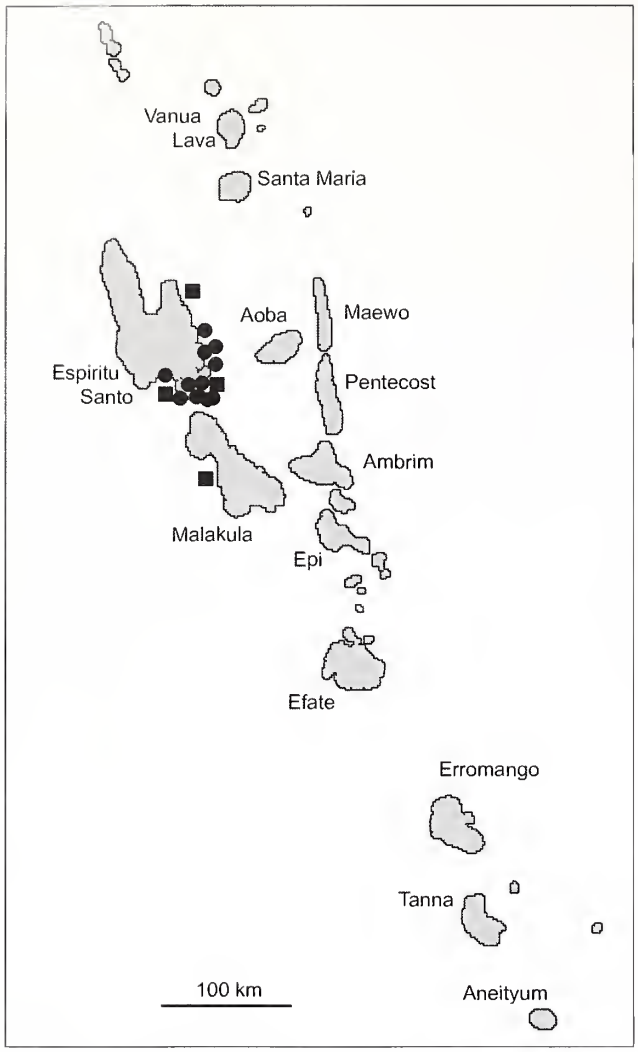


Fig. 3. Selected sampling locations from expeditions to the Vanuatu Islands. ■ Musorstom 8, 1994; ● Santo, 2006.

Fig. 3. Località di campionamento selezionate dalle spedizioni alle Isole Vanuatu. ■ Musorstom 8, 1994; ● Santo, 2006.

Material examined

The type material and Exp. Vauban 1976, New Caledonia South: Stn 40, 250-350 m, 30 sh; Bathus 1 1993, New Caledonia, East coast: Stn DW 683, 380-400 m, 1 sh (juv); Stn DW 1233, 45-50 m, 1 sh; Exp. Vauban 1978/79 - New Caledonia: Stn 2, 425/430 m, 1 sh; Exp. Orstom1987 - New Caledonia, Canala Sector, East coast: Stn 748, 35 m, 1 sh; Musorstom 3 - Philippine Islands, N/O "Coriolis" 1985: Stn DR 137, 56 m, 2 sh; Campagne Lagon, 1992 - New Caledonia, Nouméa Sector SW: Stn 1351, intertidal, 1 lv and 2 sh; Stn 1352, Noumea Lagoon, Great Abore Reef, 12-37 m, exterior slope, 5 lv (in alcohol); Stn 1371, 12-16 m, 7 lv and 1 sh; Exp. Montrouzier Sept. '93 - New Caledonia, Touho Sector East coast: Stn 1240, 0-2 m, 5 lv and 2 sh; Stn 1245, intertidal, 1 sh (juv); Stn 1255, 1 lv; Stn 1259, 15-35 m, 1 sh; Stn 1260, 49-59 m, 7 sh; Stn 1261, 45-56 m, 1 sh; Stn 1264, 8 m, 1 sh (juv) and 1 sh; Stn 1266, 10-15 m, 1 sh (juv); Stn 1269, 15-20 m, 16 lv (1 lv, **Figs 8A-C, 19K**) and 11 sh; Stn 1270, 10-35 m, 7 lv and 2 sh; Stn 1271, 5-25 m, 5 lv and 9 sh; Stn 1272, 10 m, 1 lv and 8 sh; Stn 1273, 20 m, 12 lv and 5 sh; Exp. Montrouzier Oct. '93 - New Caledonia, Koumac Sector NW: Stn 1279, intertidal, 2 lv and 1 sh; Stn 1284, intertidal, 5 lv (1 juv) and 3 sh (1 juv); Stn 1289, intertidal, 1 sh (juv); Stn 1292, intertidal, 1 lv (juv); Stn 1299, 12-14 m, 1 lv (juv); Stn 1300, 10-11 m, 1 sh *C.* cf. *sepimentum*; Stn 1308, 15-20 m, 3 lv (1 juv) and 1 sh; Stn 1310, 15 m, 15 lv (juv) and 36 lv; Stn 1312, 26-40 m, 55 lv (10 juv) and 2 sh; Stn 1312, 26-40 m, 10 lv (in alcohol); Stn 1316, 12 m, 36 lv (9 juv); Stn 1318, 20-30 m, 87 lv (35 juv) and 7 sh; Stn 1318, 20-30 m, 8 lv (in alcohol); Stn 1319, 15-20 m, 28 lv (11 juv) and 5 sh; Stn 1319, 15-20 m, 1 lv (in alcohol); Stn 1331, 55-57 m, 13 lv (1 juv) and 37 sh (8 juv); Musorstom 8, 1994, Vanuatu Islands: Stn DW 1105, 154-179 m, 1 sh; Stns CP 1131-1132, 140-182 m, 12 sh; Musorstom 10, 1998, Fiji Islands: Stn DW 1314, 656-660 m, 8 sh; Stn DW 1333, 200-215 m, 5 sh; Stn DW 1345, 660-663 m, 1 sh; Stn DW 1376, 497-504 m, 3 sh; Stn DW 1381, 275-430 m, 1 lv and 50 sh; Stn DW 1384, 260-305 m, 2 sh; Stn CP 1353, 879-897 m, 2 sh; Stn CP 1366, 149-168 m, 2 sh; Atelier Lifou 2000, Loyalty Islands, Lifou, Santal Bay: Stn 1406, intertidal area surrounding the yachtman's wharf, 1 lv and 1 sh; Stn 1410, 2-4 m, 8 lv and 4 sh; Stn 1414, 4-7 m, 2 lv and 1 sh; Stn 1415, 3-7 m, 1 lv; Stn 1420, 4-5 m, 2 sh; Stn 1421, 4 m, 4 lv and 4 sh; Stn 1422, 4 m, 2 sh; Stn 1423, sandy passage between mounds, 1 lv and 24 sh; Stn 1426, 4-7 m, 3 sh; Stn 1427, 10 m, 2 sh; Stn 1429, 8-18 m, 25 lv and 11 sh; Stn 1430, 20-25 m, 11 sh; Stn 1432, 12-32 m, 8 lv and 6 sh; Stn 1434, 5-20 m, 4 lv and 49 sh; Stn 1435, 5-30 m, 11 lv and 5 sh; Stn 1436, 10-20 m, 1 lv and 4 sh; Stn 1442, 47 m, 1 lv and 7 sh; Stn 1444, 9-20 m, 9 sh; Stn 1448, 20 m, 2 sh; Stn 1449, 17 m, 27 lv and 9 sh; Stn 1450, 27-31 m, 47 lv and 18 sh; Stn 1450, 27-31 m, 4 lv (in alcohol); Stn 1451, 10-21 m, 4 lv and 48 sh; Stn 1451, 10-21 m, 3 lv (in alcohol); Stn 1453, 21-30 m, 25 lv and 8 sh; Stn 1453, 21-30 m, 3 lv (in alcohol); Stn 1454, 15-18 m, 148 lv, 3 sh and 2 protoconchs (lv) (**Fig. 8F, G**); Stn 1454, 15-18 m, 12 lv (in alcohol); Stn 1455, 15-20 m, 8 lv and 6 sh; Stn 1456, 25-30 m, 16 lv and 10 sh; Stn 1457, 5-10 m, 119 lv and 11 sh; Stn 1457, 5-10 m, 6 lv (in alcohol); Stn 1459, 55-80 m, 2 lv and 4 sh; Stn 1462, 70-120 m, 1 sh; Santo Marine Biodiversity Survey 2006, Vanuatu Islands: Stn DB 08, 12 m, 13 lv and 11 sh; Stn DB 12, 10-18 m, 45 lv and 16 sh; Stn DB 14, 10-14 m, 1 lv and 1 sh; Stn DB 16, 32-40 m, 28 lv and 11 sh; Stn DB 20, 22-25 m, 32 lv and 39 sh; Stn DB 25, 10 m, 2 lv and 6 sh; Stn DB 29, 15 m, 10 lv and 2 sh; Stn DB 33, 14-25 m, 3 sh; Stn DB 40, 5 m, 2 sh; Stn DB 46, 2-3 m, 1 sh; Stn DB 53, 5 m, 4 lv and 6 sh; Stn DB 58, 6-43 m, 5 lv and 9 sh; Stn DB 61, 41 m, 7 lv and 1 sh; Stn DB 63, 21 m, 7 lv and 1 sh; Stn DB 65, 13 m, 1 lv and 3 sh; Stn DB 67, 7 m, 2 lv and 7 sh; Stn DB 69, 38 m, 11 lv and 20 sh; Stn DB 71, 7 m, 11 lv; Stn DB 75, 20 m, 2 lv; Stn DB 77, 42-45 m, 10 lv and 7 sh; Stn DB 80, 18 m, 11 lv; Stn DB 83, 6 m, 8 lv; Stn DS 43, 22 m, 10 sh; Stn DB 86, 13 m, 7 sh; Stn DS 10, 6-24 m, 1 lv and 4 sh; Stn DS 49, 10-17 m, 3 sh; Stn DS 93, 70 m, 3 lv and 2 sh; Stn DS 96, 114 m, 4 lv and 11 sh; Stn DS 99, 100-105 m, 7 lv and 2 sh; Stn DS 102, 98-100 m, 8 lv and 6 sh; Stn DS 105, 92 m, 3 lv and 11 sh; Stn DS 108, 100 m, 1 sh juv.; Stn ED 11, 23-33 m, 9 lv; Stn EP 01, 46-47 m, 42 lv and 14 sh; Stn

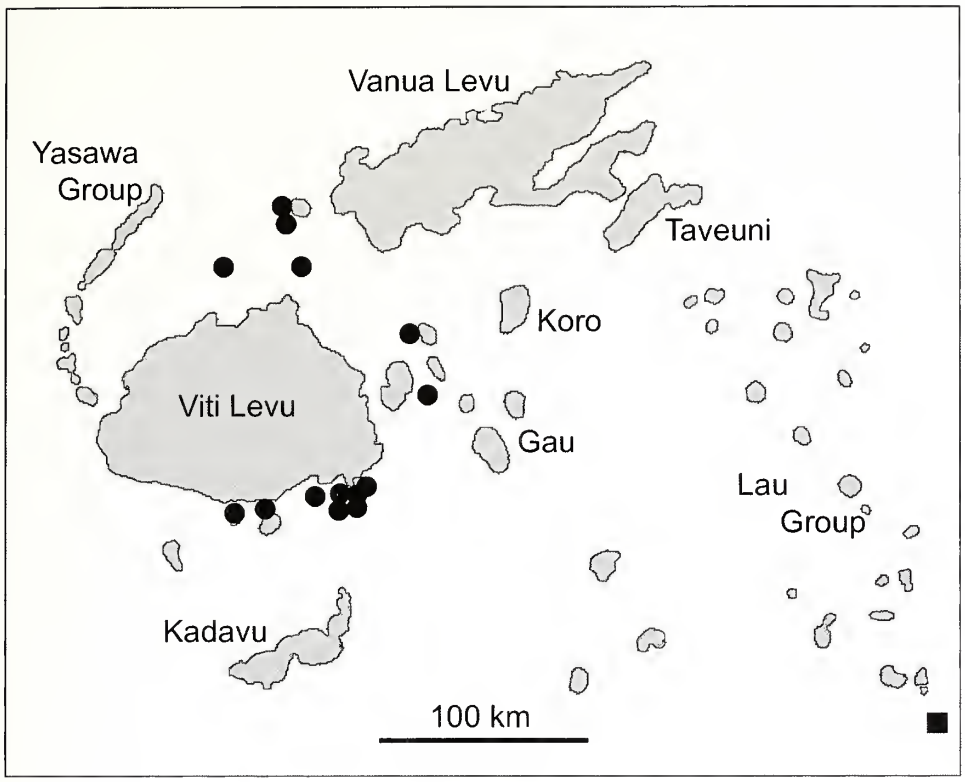


Fig. 4. Selected sampling locations from expeditions to the Fiji Islands. ● Musorstom 10, 1998; ■ Bordau 1, 1999.

Fig. 4. Località di campionamento selezionate dalle spedizioni alle Isole Fiji. ● Musorstom 10, 1998; ■ Bordau 1, 1999.

EP 10, 45-101 m, 13 lv and 1 sh; Stn EP 19, m, 1 sh; Stn EP 21, 99 m, 4 sh; Stn EP 22, 78-91 m, 9 lv and 34 sh; Stn EP 24, 108-121 m, 1 sh; Stn EP 28, 90-110 m, 6 sh; Stn EP 32, 100 m, 1 lv; Stn EP 34, 40-80 m, 15 lv and 1 sh; Stn EP 35, 10-51 m, 4 lv; Stn EP 36, 20-60 m, 17 lv; Stn EP 37, 50-61 m, 6 lv; Stn EP 38, 90-93 m, 2 lv; Stn EP 39, 75-80 m, 109 lv and 3 sh; Stn FB 40, 9 m, 20 lv and 1 sh; Stn FB 43, 19 m, 38 lv; Stn FB 52, 7 m, 3 lv and 12 sh; Stn FB 56, 3-18 m, 7 lv; Stn FB 61, 2-3 m, 2 sh; Stn FB 64, m, 8 lv and 5 sh; Stn FB 68, 11 m, 4 lv; Stn FB 72, 16 m, 1 lv and 16 sh; Stn FB 80, 2 m, 2 sh; Stn FB 83, 8-20 m, 1 lv and 15 sh; Stn FB 90, 36-39 m, 63 lv and 6 sh; Stn FB 92, 2-4 m, 4 sh; Stn FP 46-49, 45-50 m, 42 lv; Stn FS 54, 20-31 m, 1 sh; Stn FS 77, 29 m, 2 sh; Stn FS 82, 8-20 m, 2 sh; Stn FS 84, 8-9 m, 1 sh; Stn LD 29, 10-12 m, 10 sh; Stn LD 36, 8-10 m, 1 sh; Stn LS 17, 7 m, 1 sh; Stn NB 12, 20 m, 17 lv and 5 sh; Stn NB 43, 6-30 m, 20 lv and 3 sh; Stn NS 37, 2-3 m, 2 sh; Stn ZB 06, 30 m, 14 lv and 1 sh; Stn ZB 09, 5-7 m, 32 lv and 15 sh; Stn ZB 16, ca. 5 m, 2 lv and 1 sh; Stn ZO 24, 26 m, 1 lv.

Additional material

Many lots (lv and sh) from New Caledonia (Loyalty Islands), Fiji Islands, Society Islands, Coral Sea, Tonga, Papua - New Guinea, Solomon Islands, Cook Islands, Lord Howe Is., Tasman Sea (all AMS), Australia (WAM) and from Yemen, Kenya, Andaman Islands, Madagascar, Midway Islands (LACM), Sudan, Egypt, Jordan, Indonesia, Philippine Islands, Hawaiian Islands (all MP), Okinawa, Japan (LACM), Papua - New Guinea, Kwajalein Atoll (Marshall Islands) (all BR), South Africa (NMSA).

Additional description

Protoconch planispiral, of about 2 whorls, smooth and transparent, with a slight collabral rim separating it from the teleoconch. Tube subcylindrical, slightly curved and crossed by 20-25 raised rings with interspaces as large as the rings. Longitudinal microsculpture crossing the entire tube both on the rings and the interspaces. Septum discoidal and usually quite low under the cutting plane with traces of temporary septum. Aperture perfectly circular, with a swelling, crossed by 4-5 rings, at the beginning slightly contracted, then enlarging and forming a small and sharp edge. Operculum corneous, light brown; external surface crossed by 3-4 concentric small rings; the internal surface, in profile, stair-likes shaped (3 steps), showing a sunken nucleus. Colour dark brown in fresh specimens with periostracum, white in the beached ones. Mean dimensions: length 2.0 mm; diam. 0.4 mm.

Distribution

Known throughout the entire Indo-Pacific including Japan, as *C. maculatum* Habe, 1963 (Hasegawa, 2000). Herein new records are reported from Melanesia and the eastern and southern coasts of Africa.

Remarks

C. sepimentum has a temporary septum, which is somewhat different from the definitive one, being more protruding and dome-shaped, quite similar to that of *C. vertebrale*. A protoconch with about 2 whorls, was found

Fig. 5. Selected sampling location from the Musorstom 3, 1985 expedition to the Philippine Islands.

Fig. 5. Località di campionamento selezionate dalla spedizione Musorstom 3, 1985 alle Isole Filippine.

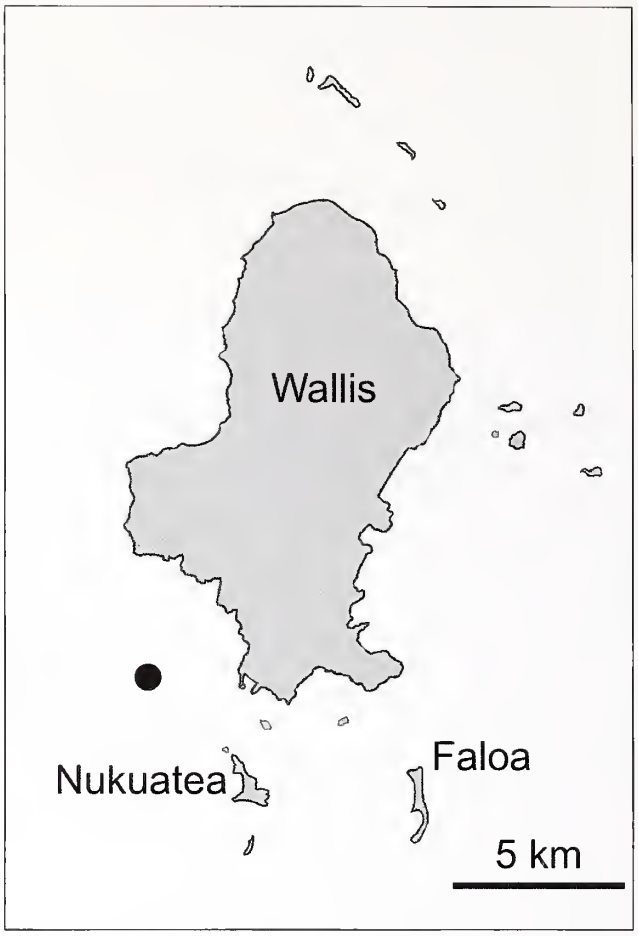


Fig. 6. Selected sampling location from the Musorstom 7, 1992 expedition to the Wallis Islands.

Fig. 6. Località di campionamento selezionate dalla spedizione Musorstom 7, 1992 alle Isole Wallis.

at Stn 1454 from Loyalty Islands together with 150 specimens of *C. sepimentum*. The annulated sculpture and the longitudinal microsculpture of the first uncoiled portion of the teleoconch immediately following the protoconch (**Fig. 8F, G**), allows us to be rather sure about its identitification as *C. sepimentum*.

This species has a planktotrophic development. For the differences between *C. sepimentum* and *C. vertebrale* see the remarks on the latter. Because of the difficulties in separating the two species and for the stability of the nomenclature, we found it necessary to select a lectotype for *C. sepimentum* (**Fig. 8D**). Lightfoot's name *septimentum* (1992: pp. 3, 4) is a misspelling by the American author. *C. sepimentum* var. *arcuata* Folin, 1879, is undoubtedly a juvenile specimen of *C. sepimentum*, since it shows the same characters of septum, ring-shaped sculptures and microsculpture. The only differences that can be seen are the more curved and accentuated subcylindrical shape of *arcuata*, and greater number of rings, all typical juvenile characters of this species. *C. maculatum* Habe, 1963 (**Fig. 8E**) and *C. lilianum* Hedley, 1902 seem to be conspecific with this species as well. The fossil *C. berberense* Ladd, 1972 (**Fig. 8H**) is clearly a junior synonym of *C. sepimentum*, as confirmed by Pizzini & Raines (2011).

Caecum vertebrale Hedley, 1899
(Figs 8I, 8K-M, 19G)

Caecum vertebrale Hedley, 1899a: p. 425, fig. 15.
Caecum multiannulatum Folin *in* Dautzenberg & Bouge, 1933: p. 354.
Caecum gracile Carpenter, 1858 - Geiger et al., 2007: p. 3, fig. 1.

Type material

C. vertebrale Hedley, 1899 holotype AMS n. C5917 (**Fig. 8I**).

Type locality

Atoll of Funafuti (Ellice Group).

Material examined

The type material and Vauban 1976, New Caledonia: Stn 40, 22°30'S, 166°24'E, 250-350 m, 1 sh; Vauban 1978-79: Stn 2, 22°17'S, 167°14'E, 425-430 m, 1 sh; Exp. Montrouzier Sept. '93 - New Caledonia, Touho Sector East coast: Stn 1273, External Reef, Touho Pass, 20°50.4'S, 165°22.8'E, hard bottom, spots of sandy muddy sand, 20 m, 1 sh; Musorstom 10 1998, Fiji Islands: Stn DW

1333, Bligh Water, 200-215 m, 1 sh (coated); Stn DW 1381, S of Viti Levu, 275-430 m, 4 sh; Stn DW 1384, SE of Viti Levu, 260-305 m, 1 sh; Stn CP 1354, S of Viti Levu, 959-963 m, 2 sh; Atelier Lifou 2000, Loyalty Islands, Lifou, Santal Bay: Stn 1412, 2-5 m, 1 sh; Stn 1423, 1 sh; Stn 1429, 8-18 m, 2 sh; Stn 1432, 12-32 m, 1 sh; Stn 1434, 5-20 m, 1 lv and 2 sh; Stn 1436, 10-20 m, 1 sh; Stn 1442, 47 m, 2 sh (1 juv); Stn 1444, 9-20 m, 1 sh; Stn 1448, 20 m, 3 sh; Stn 1449, 17 m, 1 sh; Stn 1450, 27-31 m, 1 sh; Stn 1454, 15-18 m, 1 lv and 2 sh; Stn 1457, 5-10 m, 2 lv + 1 lv (in alcohol) + 3 sh; Santo Marine Biodiversity Survey 2006, Vanuatu Islands: Stn DB 01, 15-25 m, 1 lv; Stn DB 16, 32-40 m, 1 sh; Stn DB 20, 22-25 m, 2 lv and 2 sh; Stn DB 29, 15 m, 1 lv and 1 sh; Stn DB 58, 6-43 m, 1 sh; Stn DB 63, 21 m, 1 sh; Stn DB 65, 13 m, 1 sh; Stn DS 10, 6-24 m, 1 sh; Stn FB 43, 19 m, 1 lv; Stn ZB 09, 5-7 m, 3 sh; Stn ZM 15, intertidal, 2 sh.

Additional material

Many lots (lv and sh) from Society Islands, Papua - New Guinea (all AMS) and Seychelles Islands, Egypt, Sudan, Tanzania, Kenya, Andaman Islands, Réunion Is., Philippine Islands, Australia, Japan, Hawaiian Islands, (all MP); Japan (BR), French Polynesia, Tuamotu Archipelago (LACM 73-94), South Africa (NMSA), Samoan Islands (Enrico Schwabe, ZSM, pers. comm.).

Additional description

Tube weakly subcylindrical, crossed by thin rings, regularly and slightly raised, ranging from 25 to 36, with interspaces as wide as the rings. Some specimens show the central area of the tube sculptured with rings varying from slightly raised to nearly missing. Microsculpture of faint longitudinal lines crossing the entire length of the tube less visible in the interspaces. Periostracum light brown; some shells appear somewhat darker and have an obsolete or vague microsculpture. Septum dome-shaped, slightly raised beyond the cutting plane, without any type of mucro. Aperture slightly contracted, crossed by a few small rings, forming nearly a continuum with the rest of the tube. Operculum light brown: external surface with 9-10 small concentric rings, internal surface with some indistinct rings. Colour whitish in beached specimens. Soft parts unknown. Dimensions: length 2.8 mm; max. diam. 0.6 mm, min. diam. 0.4 mm.

Distribution

The geographical distribution includes southern Japan (Hasegawa, 2000: pl. 85, fig. 3), Okinawa (Japan) (LACM), Loyalty Islands, New Caledonia, Fiji Islands, Vanuatu Islands, Society Islands (MNHN), Tuamotu Archipelago (LACM), Mahè Is. (Seychelles Islands), Mahui Is. and Lanai Is. (Hawaiian Islands), Papua - New Guinea (AMS), Philippine Islands and Australia, Andaman Islands, Egypt and Sudan (Red Sea), Zanzibar (Tanzania), Kenya, Réunion Is. (all MP), Mozambique Channel (Albano & Pizzini, 2011).

Remarks

The most similar species is *C. sepimentum*, differing in the form of the aperture, hemmed by an asymmetrical varix, and in the rings with a rather sharp top. Furthermore the two species have significantly different operculum shapes: the inner surface is stair-like in *sepimentum* (**Fig. 19K**), while in *vertebrale* it consists of 9-10 low concentric rings (**Fig. 19G**).

By observing the worn holotype of *C. exile* Folin, 1879 stored in NHMUK (**Fig. 8J**), we agree with Lightfoot's conclusions (1992b: p. 4), about the impossibility to refer *exile* to *vertebrale* but for different reasons: in our opinion the two species are not conspecific, because of a different apertural sculpture, and a higher number of rings in *exile*.

The type material of *C. gracile* Carpenter, 1858 is unkown. On the basis of its original description and the only available photograph in Johnson (1964: p. 240, fig. 6), we suspect that *C. gracile* Carpenter, 1858 may be conspecific with *vertebrale*, but the holotype of *gracile* appears too badly worn to be properly compared. We then consider *gracile* as a *nomen dubium*, and although the latter may have priority, we prefer using the taxon *C. vertebrale* instead of *C. gracile* Carpenter, 1858 for the stability of the nomenclature.

As to the claimed difficulty of Lightfoot (1992b) about the difference between *C. vertebrale* and *C. oahuense* Pilsbry, 1921 (1992b: p. 4) in observing "...conspicuous traces of microscopic longitudinal striae covering the whole shell...", we have found only an indistinct longitudinal microsculpture which is not actually comparable to a real striation in all the specimens from the other mentioned localities. We believe that Lightfoot noted difficulty regarding the differences between *C. vertebrale* and *C. oahuense*, since the comparison was only based on the "...worn-looking area in the middle" of the latter, and having a few other morphological characters in common. *C. oahuense* seems to be much more similar to *C. vertebrale* than *C. sepimentum*, as stated by Pilsbry, but in our opinion they are three distinct and valid species (Pizzini & Raines, 2011: p. 8). With regard to *C. lilianum* Hedley, 1902, we do not agree with Hedley's conclusion about the similarity of this species with *C. vertebrale*, whose septum is not "flat" like in *lilianum*, but dome shaped, always emerging from the cutting plane. The shape of the septum in *C. lilianum* led us to conclude that Hedley's comparison was incorrect (1902: 603, pl. 29, fig. 7) because it really refers to *C. sepimentum* which shows the same morphological character. *C. lilianum* Hedley, 1902, may be thus a junior synonym of *C. sepimentum* Folin, 1868. The specimen figured by Geiger et al. (2007: fig. 1) under the name *Caecum gracile* Carpenter, 1858 should be referred to as *C. vertebrale*.

Caecum clarum Lamy ex Folin ms., 1909
(Fig. 8N, O, Q)

Caecum clarum Lamy ex Folin ms., 1909: pp. 317, 318, pl. 15, fig. 9.

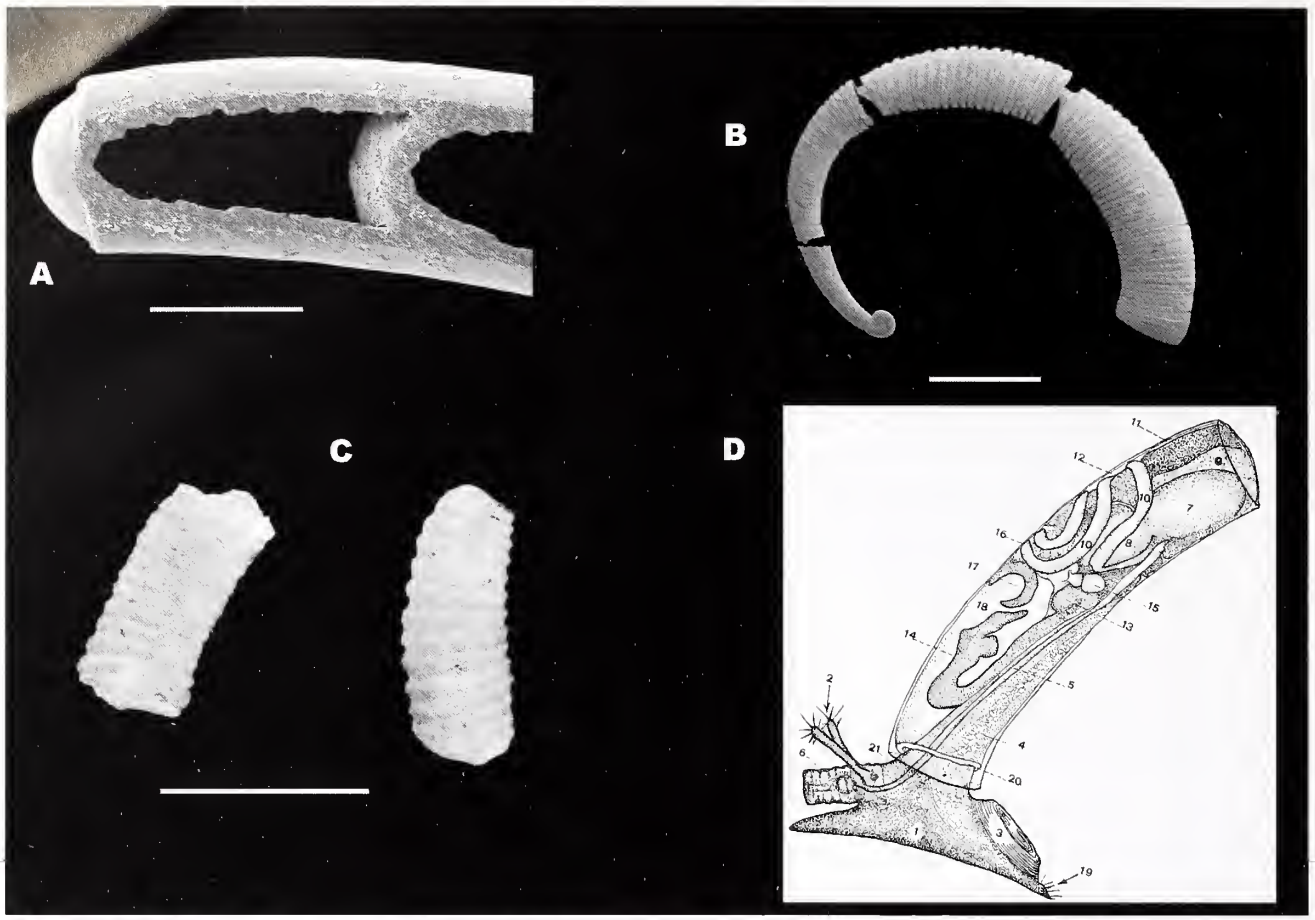


Fig. 7. A. Longitudinal section of *Caecum subannulatum* Folin, 1870 (scale bar = 200 µm). **B**. *Caecum dalli* Bartsch, 1920 (growth stages), 10 m, Anacapa Is., Santa Barbara, California, LACM 69-33 (scale bar = 1 mm). **C.** *Odontidium rugulosum* Philippi, 1836, 2 syntypes NHMUK 1857.6.4.1529 (scale bar = 1 mm). **D.** Gross anatomy of *Caecum glabrum* (Montagu, 1803), after Götze (1938): 1) foot; 2) ciliated tentacles and eyes; 3) operculum; 4) columellar muscle; 5) oesophagus; 6) radula; 7) stomach; 8) crystalline style sac; 9) digestive gland; 10) intestine; 11) gonad; 12) seminal vesicle; 13) vas deferens; 14) penis; 15) heart; 16) kydney; 17) osphradium; 18) pallial cavity; 19) cilia; 20) mantle edge; 21) statocyst.

Fig. 7. A. Sezione longitudinale di *Caecum subannulatum* Folin, 1870 (scala = 200 µm). **B**. *Caecum dalli* Bartsch, 1920 (stadi di accrescimento), 10 m, Anacapa Is., Santa Barbara, California, LACM 69-33 (scala = 1 mm). **C.** *Odontidium rugulosum* Philippi, 1836, 2 sintipi NHMUK 1857.6.4.1529 (scala = 1 mm). **D.** Schema anatomico di *Caecum glabrum* (Montagu, 1803), da Götze (1938): 1) piede; 2) tentacoli con ciglia vibratili e occhi; 3) opercolo; 4) muscolo columellare; 5) esofago; 6) radula; 7) stomaco; 8) sacco dello stilo cristallino; 9) ghiandola digestiva; 10) intestino; 11) gonade; 12) vescicola seminale; 13) vaso deferente; 14) pene; 15) cuore; 16) rene; 17) osfradio; 18) cavità del mantello; 19) ciglia; 20) margine del mantello; 21) statocisti.

Caecum heterapex Habe, 1963: p. 236. (*syn. nov.*) non Habe, 1978: p. 5, pl. 1, fig. 10.
Caecum sp. b Bosch et al., 1995: p. 49.
Caecum ruggerii Pizzini, 1997: pp. 23-26, figs 1-8.

Type material

C. clarum Lamy ex Folin ms., 1909: 55 syntypes MNHN from type locality; the shell figured by Lamy (1909: pl. 15, fig. 9) (**Fig. 8Q**).

Type locality

Nossibé (Madagascar).

Material examined

The type material and *C. heterapex* Habe, 1963, holotype NSMT - Mo 39925 (ph) (**Fig. 8P**); *C. varanoi* Pizzini, Nofroni & Bonfitto, 2008, holotype AMS C415402 - n. 000384C (**Fig. 9B, C**); Exp. Montrouzier Sept. '93 - New Caledonia, Touho Sector East coast: Stn 1240, 0-2 m, 1 sh; Exp. Montrouzier Oct. '93 - New Caledonia, Koumac Sector NW: Stn 1277, 0-2 m, 2 sh coated; Stn 1279, intertidal, 1 sh.

Additional material

Many lots (lv and sh) from Papua - New Guinea, New Caledonia (Noumea) (all AMS) and Australia (WAM), Western Australia, Dampler Arch, (LACM 87-101), Thailand, (LACM 85-5).

Additional description

Tube moderately arched, nearly straight, especially on the first half, with strong sculpture consisting of pronounced raised rings ranging from 22 to 31, sometimes strongly developed so giving a unique wavy silhouette. The rings appear acute in cross-section at the top, distinctly and strongly raised, with U-shaped interspaces, usually about the same width as the rings, sometimes less. Longitudinal microsculpture in the interspaces and

on the rings. Aperture weakly thickened, without varix. Septum nearly flat, not recessed with respect to the cutting plane. Mucro markedly protruding, rather variable in general shape, usually oriented toward the exterior and to the right, from 10° to 45°: ventral margin flat or slightly convex, dorsal margin S-shaped. Aperture perfectly circular. Operculum thin, light brown; external surface showing a sculpture of about 9 irregular concentric rings from the outer margin to the center. Inner surface sicrossed by 9 to 11 concentric rings with the nucleus weakly raised. Protoconch, growth stages (except 2nd stage) and soft parts unknown. Colour grayish in beached specimens, opaque. Dimensions: length 3.4 mm.

Distribution

Originally described from the Indian Ocean (Madagascar) and subsequently as *C. ruggerii* Pizzini, 1997 from the Red Sea (Scek-Said, Dahlak Arch., off Massaua, Eritrea). Herein its distribution is extended to New Caledonia (MNHN), Papua - New Guinea (AMS) and Australia (WAM and LACM), Thailand (LACM).

Remarks

Lamy (1909: p. 317) reports fifty shells coming from Nossi-bé (Madagascar) labelled as *C. clarum* by Folin. However, the type series of *C. clarum* (MNHN) actually includes 55 syntypes from the type locality, while the sample picked up by M. F. Geay and figured by Lamy comes from Sarodrano (off Tuléar, Madagascar) (**Fig. 8Q**).
Habe (1963: p. 236) described *C. heterapex* without any illustration, then subsequently (1978: p. 5, pl. 1, fig. 10), he introduced a photograph of a shell that does not agree with the original description. Furthermore, neither does it agree with the shell figured by Hasegawa (2000: p. 170, fig. 4), nor with the holotype NMNS - Mo 39925 (**Fig. 8P**), also figured by Higo, Callomon & Gotō (1999: p. 33, fig. G977), clearly belonging to *clarum* and therefore the species of Habe is here considered a synonym. The shell figured by Hasegawa with the name *C. heterapex*, seeming to be yet another species further distinguished and described by Pizzini et al. (2008) as *C. varanoi* (**Fig. 9A-C**). *Caecum ruggerii* Pizzini, 1997, described from Dahlak Arch. (Red Sea) is clearly a junior synonym of *C. clarum* as well.

Caecum varanoi Pizzini, Nofroni & Bonfitto, 2008 (Fig. 9A-C)

Caecum heterapex Hasegawa, 2000: p. 170, fig. 4 (non Habe, 1963).
Caecum varanoi Pizzini et al., 2008: p. 20-22, fig. 1A-F.

Type material

Caecum varanoi Pizzini, Nofroni & Bonfitto, 2008, holotype AMS C415402 - n. 000384C from type locality (**Fig. 9B, C**).

Type locality

Papua - New Guinea, Milne Bay (about 400 Km E of Port Moresby), 10°23.000′S, 150°25.000′E.

Material examined

The type material and *C. heterapex* Habe, 1963, holotype NMNS - Mo 39925 (ph) (**Fig. 8P**); Santo Marine Biodiversity Survey 2006, Vanuatu Islands: Stn LD 30, 7-8 m, 1 sh.

Additional description

Tube slightly curved, clearly subcylindrical in the adapical portion, then regularly cylindrical, with about 42 somewhat raised, regularly spaced, transverse rings, stronger at periphery of shell, sometimes weaker or rather obsolete in the center, with interspaces nearly as wide as the rings. Intervals crossed by longitudinal, irregular, very fine microstriae, extending to tip of ribs. Septum strongly protruding over the cutting plane, provided with a unique tongue-like shaped mucro, oriented toward right side at about 25°-30° in ventral view, with deeply concave dorsal margin. Aperture without swelling, surrounded by 4-5 strong rings. Shell yellowish in colour. Protoconch, operculum and soft parts unknown. Holotype dimensions: length 3.3 mm; diameter 0.5-0.6 mm.

Distribution

Described from Papua - New Guinea, later extended to Thailand and Samoan Islands (Pizzini et al., 2008) and to Japan - as C. heterapex Habe, 1963 sensu Hasegawa, 2000 - the geographical distribution of the new species is herein extended to Vanuatu Islands and to Great Bitter Lake, Suez Canal (L. Micali, pers. comm.).

Remarks

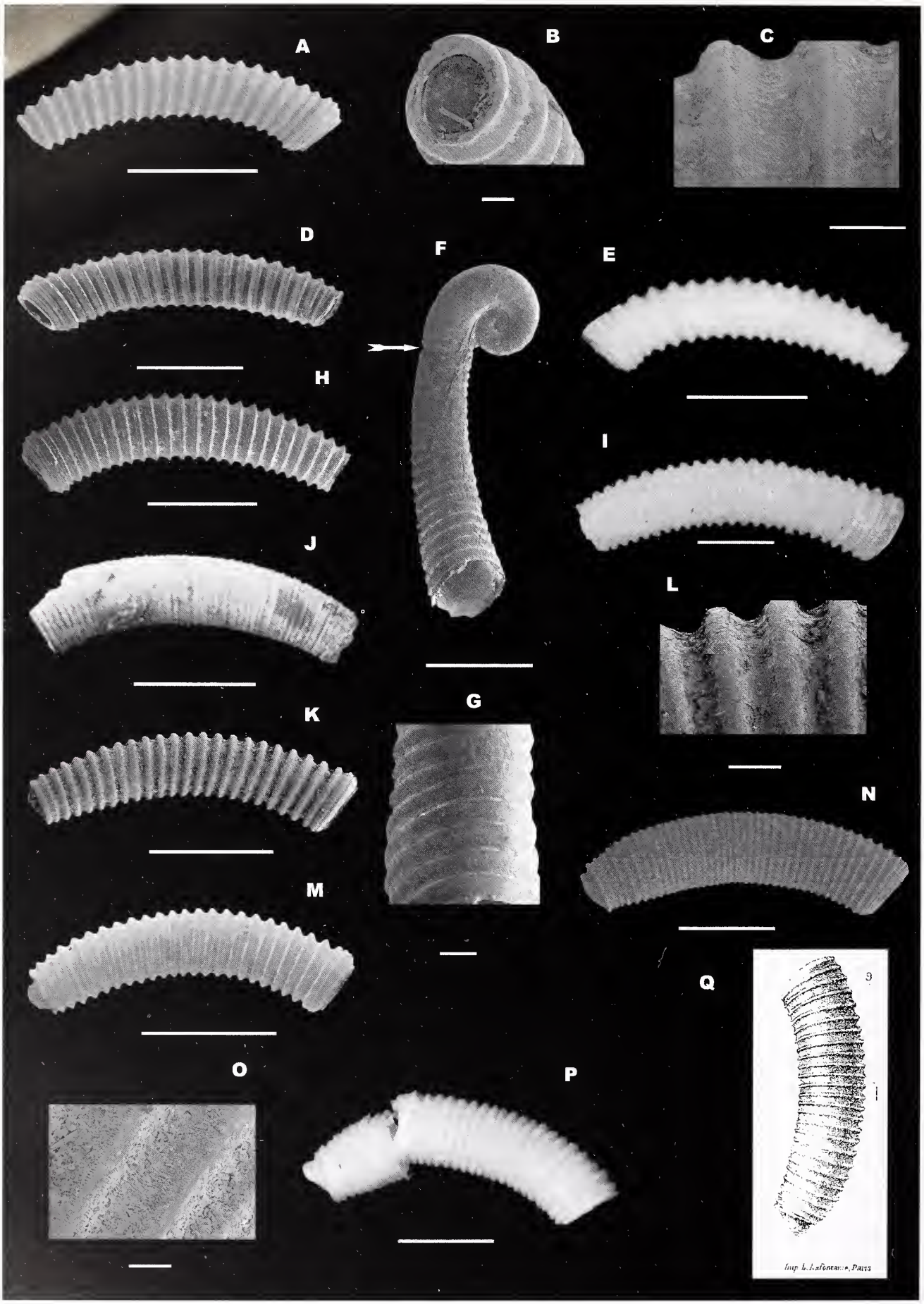
The single specimen shows transverse rings in the adapical and abapical portions of the tube (**Fig. 9A**), while in the middle of the tube they are more or less obsolete as pointed out in the original description. This species is somewhat similar to *C. clarum* Lamy ex Folin ms., 1909 (**Fig. 8N**) in shape and sculpture. The main differences consisting in *varanoi* with its unique septum shape and fewer number of rings, the subcylindrical shape of the adapical portion of tube and larger size.

Caecum smriglioi Pizzini, Nofroni & Bonfitto, 2008 (Fig. 9D-F)

Caecum smriglioi Pizzini et al., 2008: pp. 23-24, figs 2A-C.

Type material

Caecum smriglioi Pizzini, Nofroni & Bonfitto, 2008: holotype MZB (**Fig. 9F**).



Mauro Pizzini, Bret Raines & Angelo Vannozzi

Type locality

Hikkaduwa (Srî-Lanka), SW coast, about 200 km S of Colombo, 4 m depth, sandy bottom.

Material examined

The type material and Exp. Montrouzier Sept. '93 - New Caledonia, Touho Sector Ecoast: Stn 1259, Touho Bank, outfalls with silt, 15-35 m, 1 sh; Santo Marine Biodiversity Survey, 2006, Vanuatu Islands: Stn FB 64, m, 1 sh.

Additional description

Tube slightly curved, slightly subcylindrical only towards the adapical side, then perfectly cylindrical to the end. Sculpture of about 23 strongly raised, acute, almost lamellar rings, with deep U-shaped interspaces, nearly as wide as the rings, giving a characteristic wavy outline, with a sinuous shape of the rings from the adapical portion of the tube to the half of its length. Interspaces crossed by very fine, longitudinal, worm-like microstriae, extending to rings. Aperture large, with outer swelling surrounded by 5 thin rings. Septum slightly recessed, with a pointed mucro usually oriented to the right side at 30° to 40°. Shell milk-white. Protoconch, operculum and soft parts unknown. Dimensions: length 4 mm; max. diam. 0.95 mm.

Distribution

Described from Srî-Lanka, herein its distribution is extended to New Caledonia (Touho Sector) and Vanuatu Islands.

Remarks

The species is similar to two Indo-Pacific ringed species, *C. sepimentum* (**Fig. 8A**) and *C. vertebrale* (**Fig. 8K**). Despite the similar sculpture, the rings of *C. smriglioi* are more lamellar. The main difference regards the mucro, pointed in *C. smriglioi* (**Fig. 9E**), absent in *C. sepimentum* (**Fig. 8B**) and *C. vertebrale*.

Caecum neocaledonicum Folin, 1868
(Figs 9G, H, J, K, 19H, 21A, B)

Caecum neocaledonicum Folin, 1868c: p. 57, pl. 6, figs 1, 2.
Caecum fulvum Kisch, 1959: pp. 17-19, fig. 1.
? *Elephantanellum* sp. A Ladd, 1972†: p. 23, pl. 5, fig. 15.
Caecum linoidei Habe, 1978: p. 4, figs 11-13.
? *Caecum* (*Brochina*) sp. cf. *glabella* Kay, 1979: p. 111, fig. 42G.

Type material

Caecum neocaledonicum Folin, 1868: 17 syntypes sh, 1 juv. and 5 fragments, MNHN; lectotype selected by Pizzini, 1998 (p. 34, fig. 5) (**Fig. 9H**).

Type locality

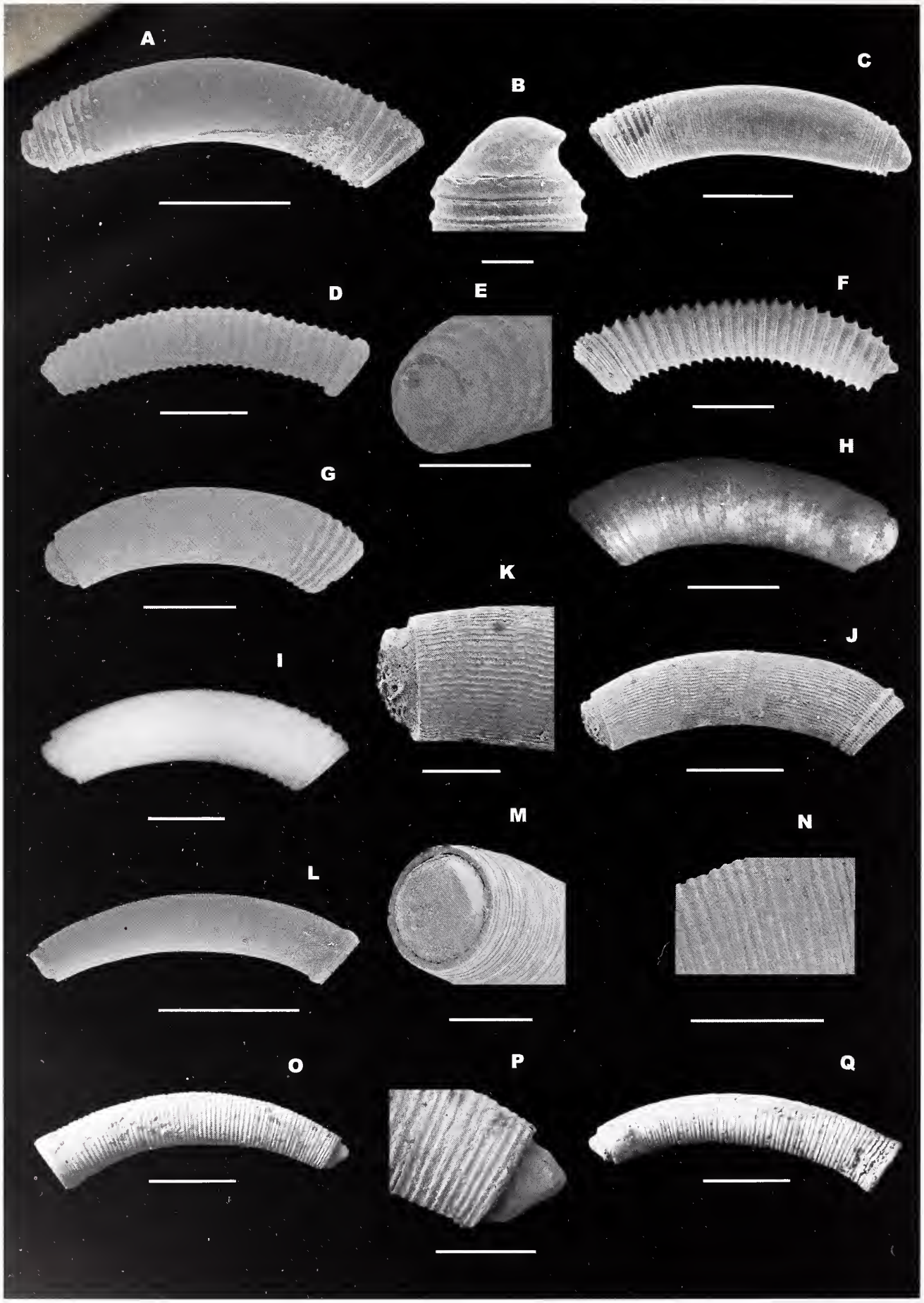
Noumea (New Caledonia).

Material examined

The type material and Campagne Lagoon, New Caledonia, Nouméa Sector SW 1992: Stn 1351, intertidal, 8 lv and 1 sh; Exp. Montrouzier Sept. '93 - New Caledonia, Touho Sector East coast: Stn 1237, 0-1 m, 1 sh; Stn 1240, 0-2 m, 2 lv and 2 sh; Stn 1242, intertidal, 5 lv and 2 sh; Stn 1248, intertidal, 1 sh; Stn 1253, 2-3 m, 1 sh; Stn 1259, 15-35 m, 1 sh; Stn 1260, 49-59 m, 1 sh; Stn 1264, 8 m, 4 sh; Exp. Montrouzier Oct. '93- New Caledonia, Koumac Sector NW: Stn 1279, intertidal, 8 lv, 3 sh, 1 juv. and a short form; Stn 1284, intertidal, 8 lv (4 juv) and 16 sh (4 juv); Stn 1291, intertidal, 3 sh (2 juv); Stn 1292, intertidal, 1 lv (juv) and 2 sh; Stn 1298, 2-4 m, hard bottom, 3 sh; Stn 1300, 10-11 m, 1 lv (juv); Stn 1300, 10-11 m, 1 lv (in alcohol); Stn 1303, 0-8 m, 10 lv; Stn 1305, 12-15 m, 1 sh (juv); Atelier Lifou 2000, Loyalty Islands: Stn 1406, intertidal, 1 sh; Stn 1410, 2-4 m, 1 sh; Stn 1412, 2-5 m, 1 sh; Stn 1419, 5 m, 1 sh (short form); Stn 1420, 4-5

Fig. 8. A. *Caecum sepimentum* Folin, 1868, Stn 1269 (scale bar = 1 mm). L = 2.5 mm. **B.** *C. sepimentum* Folin, 1868, Stn 1269, septum (scale bar = 100 μm). **C.** *C. sepimentum* Folin, 1868, Stn 1269, microsculpture (scale bar = 100 μm). **D.** *C. sepimentum* Folin, 1868, lectotype MNHN n. 24907 (scale bar = 1 mm). L = 3.1 mm. **E.** *C. maculatum* Habe, 1963, holotype NSMT (scale bar = 1 mm). L = 2.7 mm. **F.** *C. sepimentum* Folin, 1868, protoconch Stn 1454 (scale bar = 300 μm), detail of the rim separating it from the teleoconch (arrow). L = 1 mm. **G.** the same specimen, microsculpture (scale bar = 50 μm). **H.** *C. berberense* Ladd, 1972, holotype USNM 650429 (scale bar = 1 mm). L = 3 mm. **I.** *C. vertebrale* Hedley, 1899, holotype AMS n. C5917 (scale bar = 500 μm). L = 2.15 mm. **J.** *C. exile* Folin, 1879 holotype NHMUK 1887.2.9.2362, Challenger Exp. Stn 172, Tongatabu, 18 fms (scale bar = 500 μm). L = 1.35 mm. **K.** *C. vertebrale* Hedley, 1899, Stn 1457 (scale bar = 1 mm). L = 2.7 mm. **L.** *C. vertebrale* Hedley, 1899, Stn 1457, microsculpture (scale bar = 100 μm). **M.** *C. vertebrale* Hedley, 1899, Stn 1273 (scale bar = 1 mm). L = 2.4 mm. **N.** *C. clarum* Lamy (MS Folin), 1909, Stn 1240 (scale bar = 1 mm). L = 3.4 mm. **O.** *C. clarum* Lamy (MS Folin), 1909, Stn 1240, microsculpture (scale bar = 50 μm). **P.** *C. heterapex* Habe, 1978, holotype NSMT - Mo 39925, Ankyaba, Kakeroma-jima, near Amami-Oshima, Japan (scale bar = 1 mm). L = 3.3 mm. **Q.** *C. clarum* Lamy (MS Folin), 1909, orig. fig.

Fig. 8. A. *Caecum sepimentum* Folin, 1868, Stn 1269 (scala = 1 mm). L = 2.5 mm. **B.** *C. sepimentum* Folin, 1868, Stn 1269, setto (scala= 100 μm). **C.** *C. sepimentum* Folin, 1868, Stn 1269, microscultura (scala= 100 μm). **Fig. 8. D.** *C. sepimentum* Folin, 1868, lectotipo MNHN n. 24907 (scale bar = 1 mm). L = 3,1 mm **E.** *C. maculatum* Habe, 1963, olotipo NSMT (scala= 1 mm). L = 2,7 mm. **F.** *C. sepimentum* Folin, 1868, protoconca Stn 1454 (scala= 300 μm), dettaglio del bordo che lo separa dalla teleoconca (freccia). L = 1 mm. **G.** stesso esemplare, microscultura (scala= 50 μm). **H.** *C. berberense* Ladd, 1972, olotipo USNM 650429 (scala = 1 mm). L = 3 mm. **I.** *C. vertebrale* Hedley, 1899, olotipo AMS n. C5917 (scala= 500 μm). L = 2,15 mm. **J.** *C. exile* Folin, 1879 olotipo NHMUK 1887.2.9.2362, Spedizione Challenger Stn 172, Tongatabu, 18 fms (scala= 500 μm). L = 1,35 mm. **K.** *C. vertebrale* Hedley, 1899, Stn 1457 (scala= 1 mm). L = 2,7 mm. **L.** *C. vertebrale* Hedley, 1899, Stn 1457, microscultura (scala= 100 μm). **M.** *C. vertebrale* Hedley, 1899, Stn 1273 (scala= 1 mm). L = 2,4 mm. **N.** *C. clarum* Lamy (MS Folin), 1909, Stn 1240 (scala= 1 mm). L = 3,4 mm. **O.** *C. clarum* Lamy (MS Folin), 1909, Stn 1240, microscultura (scala= 50 μm). **P.** *C. heterapex* Habe, 1978, olotipo NSMT - Mo 39925, Ankyaba, Kakeroma-jima, vicino a Amami-Oshima, Japan (scala= 1 mm). L = 3,3 mm. **Q.** *C. clarum* Lamy (MS Folin), 1909, fig. orig.



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m, 1 sh; Stn 1422, 4 m, 1 sh; Stn 1423, 1 sh; Stn 1427, 10 m, 1 sh; Stn 1429, 8-18 m, 1 sh (juv); Stn 1430, 20-25 m, 1 sh; Stn 1450, 27-31 m, 1 sh; Stn 1455, 15-20 m, 1 sh; Stn 1456, 25-30 m, 1 sh; Stn 1457, 5-10 m, 1 lv and 1 sh; Musorstom 10 1998, Fiji Islands: Stn DW 1333, 200-215 m, 1 sh; Stn DW 1381, 275-430 m, 5 sh (juv); Stn DW 1384, 260-305 m, 2 sh; Stn CP 1325, 282-322 m, 1 sh; Stn CP 1363, 144-150 m, 1 sh; Stn CP 1366, 149-168 m, 1 sh; Stn CP 1369, 392-433 m, 1 sh; Santo Marine Biodiversity Survey, 2006, Vanuatu Islands: Stn DB 20, 22-25 m, 1 lv and 1 sh; Stn DB 53, 5 m, 1 lv and 1 sh; Stn DB 69, 38 m, 2 sh; Stn DB 75, 20 m, 1 sh; Stn FB 40, 9 m, 1 sh; Stn FB 90, 36-39 m, 1 sh; Stn LD 29, 10-12 m, 1 sh; Stn ZB 16, ca. 5 m, 1 lv.

Additional material

Many lots (lv and sh) from New Caledonia, Society Islands, Fiji Islands, Papua - New Guinea, Solomon Islands, Vanuatu (all AMS), Australia (WAM, Jordan, Sudan, Yemen, Mauritius Is., Zanzibar, Abu Dhabi, Egypt, Seychelles Islands, Philippine Islands, Australia, Kenya, Andaman Islands (all MP), Fiji Islands, Japan, Papua - New Guinea (all BR), Samoan Islands (Enrico Schwabe, ZSM, pers. comm.).

Additional description

Tube subcylindrical, relatively thick, moderately arched, crossed by a variable number of rings generally very weak in the central portion of the tube, stronger towards the aperture. Microsculpture formed by worm-like striae crossed by growth lines. Septum with an unguiform mucro, positioned from 70° to 90° with respect to the axis of the shell, often covered by calcareous encrustations. Whitish in beached shells, with a thick periostracum tawny to light-creamy in live specimens. Operculum corneous, light brown. Protoconch and soft parts unknown. Dimensions: mean length 3.6 mm, mean width 0.85 mm.

Distribution

Tropical and subtropical Indo-West Pacific.

Remarks

Kisch (1959b: pp. 17-19, fig. 1) described *C. fulvum* (which later turned out to be a synonym of *neocaledonicum*: Pizzini, 1998) basing his description on a table composed by Folin found at the Musée de la Mer of Biarritz, together with 25 unidentified specimens destined for his *Monographie des Caecidae*, which was never published. In addition to the figure, this table also contains a detailed manuscript on the species, integrally published by Kisch (1959b: pp. 18-19).

Juveniles of *neocaledonicum* (third growth stage) (**Fig. 9J**) are quite different from the adults, having a unique microsculpture of pronounced longitudinal worm-like striation (**Fig. 9K**), which is less visible in adults. However, the finding of specimens with the third and the fourth growth stages still attached rules out any doubt. Furthermore, juveniles of *neocaledonicum* are also quite similar to those of *C. varanoi* (Pizzini et al., 2008) (**Fig. 9A-C**). *Caecum hinoidei* (**Fig. 9I**) appears to be conspecific with *neocaledonicum* (Pizzini, 1998: p. 38). Also the fossil species *C. elephantanellum* sp. A Ladd, 1972 (USNM 650431) is suspected to belong to *neocaledonicum*.

In addition, *C. neocaledonicum* contains rare specimens in which the varices develop precociously, before reaching the usual shell length. These specimens are here referred to as "short form". This anomaly occurs also in other species, i.e. the Mediterranean *C. auriculatum* Folin, 1868 with its form *decurtata* Monterosato, 1884 (Pizzini et al., 1995) and e.g. the West Atlantic *C. breve* Folin, 1867.

Fig. 9. A. *Caecum varanoi* Pizzini, Nofroni & Bonfitto, 2008 (MNHN), Santo Exp. 2006, Vanuatu Islands, Stn LD 30 (scale bar = 1 mm). L = 3.1 mm. **B.** *C. varanoi* Pizzini, Nofroni & Bonfitto, 2008, holotype AMS C415402 - n. 000384C, septum (scale bar = 200 µm). **C.** *C. varanoi* Pizzini, Nofroni & Bonfitto, 2008, holotype AMS C415402 - n. 000384C (scale bar = 1 mm). L = 3.6 mm. **D.** *C. smriglioi* Pizzini, Nofroni & Bonfitto, 2008, Stn 1259 (scale bar = 1 mm). L = 3.8 mm. **E.** *C. smriglioi* Pizzini, Nofroni & Bonfitto, 2008, Stn 1259, septum (scale bar = 500 µm). **F.** *C. smriglioi* Pizzini, Nofroni & Bonfitto, 2008, holotype MZB (scale bar = 1 mm). L = 4 mm. **G.** *C. neocaledonicum* Folin, 1868, Stn 1303 (scale bar = 1 mm). L = 3.45 mm. **Fig. 9. H.** *C. neocaledonicum* Folin, 1868, lectotype MNHN (scale bar = 1 mm). L = 3.6 mm. **I.** *C. hinoidei* Habe, 1978, holotype NSMT, Mo 55376, Tsuchihama, Tatsugo-cho, Amami-Oshima, south of Kyushu (Japan) (scale bar = 1 mm). L = 4 mm. **J.** *C. neocaledonicum* Folin, 1868, 3rd growth stage, Stn 1450 (scale bar = 500 µm). L = 1.7 mm. **K.** *C. neocaledonicum* Folin, 1868, Stn 1450, septum and microsculpture (scale bar = 200 µm). **L.** *C. virginiae* n. sp., holotype MNHN, Stn DW 1381 (scale bar = 500 µm). L = 1.17 mm. **M.** *C. virginiae* n. sp., holotype MNHN, Stn DW 1381, septum (scale bar = 100 µm). **N.** *C. virginiae* n. sp., holotype MNHN, Stn DW 1381, microsculpture (scale bar = 100 µm). **O.** *C. attenuatum* Folin, 1880, lectotype NHMUK 1887.2.9.2315, Flinders Passage, Cape York, Australia (scale bar = 500 µm). L = 1.81 mm. **P.** *C. attenuatum* Folin, 1880, lectotype NHMUK 1887.2.9.2315, septum (scale bar = 200 µm). **Q.** *C. microcyclos* Folin 1880, syntype, NHMUK 1887.2.9.2345-2356, Flinders Passage, Cape York, Australia (scale bar = 500 µm). L = 1.8 mm.

Fig. 9. A. *Caecum varanoi* Pizzini, Nofroni & Bonfitto, 2008 (MNHN), Sped. Santo 2006, Isole Vanuatu, Stn LD 30 (scala = 1 mm). L = 3,1 mm. **B.** *C. varanoi* Pizzini, Nofroni & Bonfitto, 2008, olotipo AMS C415402 - n. 000384C, setto (scala =200 µm). **C.** *C. varanoi* Pizzini, Nofroni & Bonfitto, 2008, olotipo AMS C415402 - n. 000384C (scala = 1 mm). L = 3,6 mm. **D.** *C. smriglioi* Pizzini, Nofroni & Bonfitto, 2008, Stn 1259 (scala = 1 mm). L = 3,8 mm. **E.** *C. smriglioi* Pizzini, Nofroni & Bonfitto, 2008, Stn 1259, setto (scala = 500 µm). **F.** *C. smriglioi* Pizzini, Nofroni & Bonfitto, 2008, olotipo MZB (scala = 1 mm). L = 4 mm. **G.** *C. neocaledonicum* Folin, 1868, Stn 1303 (scala = 1 mm). L = 3,45 mm. **H.** *C. neocaledonicum* Folin, 1868, lectotipo MNHN (scala = 1 mm). L = 3,6 mm. **I.** *C. hinoidei* Habe, 1978, olotipo NSMT, Mo 55376, Tsuchihama, Tatsugo-cho, Amami-Oshima, Sud di Kyushu (Giappone) (scala = 1 mm). L = 4 mm. **J.** *C. neocaledonicum* Folin, 1868, 3° stadio di accrescimento, Stn 1450 (scala = 500 µm). L = 1,7 mm. **K.** *C. neocaledonicum* Folin, 1868, Stn 1450, setto e microscultura (scala = 200 µm). **L.** *C. virginiae* n. sp., olotipo MNHN, Stn DW 1381 (scala = 500 µm). L = 1,17 mm. **M.** *C. virginiae* n. sp., olotipo MNHN, Stn DW 1381, setto (scala = 100 µm). **N.** *C. virginiae* n. sp., olotipo MNHN, Stn DW 1381, microscultura (scala = 100 µm). **O.** *C. attenuatum* Folin, 1880, lectotipo NHMUK 1887.2.9.2315, Flinders Passage, Capo York, Australia (scala = 500 µm). L = 1,81 mm. **P.** *C. attenuatum* Folin, 1880, lectotipo NHMUK 1887.2.9.2315, setto (scala = 200 µm). **Q.** *C. microcyclos* Folin 1880, sintipo, NHMUK 1887.2.9.2345-2356, Flinders Passage, Cape York, Australia (scala = 500 µm). L = 1,8 mm.

Caecum virginiae n. sp.
(Fig. 9L-N)

Type material

Holotype (sh) MNHN 24833 and 1 paratype (sh) MNHN 24834 from type locality.

Type locality

Fiji Islands, Musorstom 10 1998:Stn DW 1381, S of Viti Levu, 18°17.8′ S, 177°54.4′ E, 275-430 m.

Additional material

Few lots (only sh) from Maldive Islands and Japan (BR).

Description

Tube subcylindrical, covered by 130 or more very thin rings, closely set, slightly raised and extremely uniform. The tube forms a swelling near the aperture crossed by small rings which are sparser than those present on the tube. Very fine longitudinal microsculpture covers the whole tube extending to the tip of ribs. Septum mucronate, protruding over the cutting plane, with the apex of the mucro slightly turned to the right. Anterior margin sinuous and S-shaped, posterior one straight. In frontal view, with the septum turned upwards, the tube shows a slight dextral torsion near the aperture. Colour white. Operculum thin, very light brown, translucent, with an external microsculpture of 6-7 concentric rings, and the centre strongly concave. Protoconch and soft parts unknown. Holotype dimensions: length 1.3 mm; width 0.2 mm.

Distribution

Currently known only from Fiji Islands (Viti Levu Is.), Maldive Islands and southern Japan (Okinawa Is.) (BR).

Etimology

This species is named after M. Virginie Héros (MNHN) who has always helped us with useful information on the material examined and giving us the opportunity to see and study the type material stored in MNHN.

Remarks

The new species (**Fig. 9L-N**) resembles *C. attenuatum* Folin, 1880 (**Fig. 9O**, lectotype NHMUK 1887.2.9.2315 herein selected), both having a S-shaped anterior margin. However, the new species is different from Folin's species for the presence of countless small rings much smaller and regular than those of *C. attenuatum*, by the presence of a swelling near the aperture, and by the posterior margin of the septum which is straight and not gibbous (**Fig. 9P**). On the other hand, Hugues comparisons (1985a: p. 167) in particular between *C. microcyclos* (Folin: p. 467) and *C. attenuatum* (Folin, p. 464) induced us to check the possible correlation between them. From the study of the type material NHMUK, we reached the conclusion that *C. microcyclos* (**Fig. 9Q**) is conspecific with *C. attenuatum* (**Fig. 9O**) which in addition has priority of page.

Caecum lapita n. sp.
(Fig. 10A-D)

Fartulum aff. *amputatum* Ladd, 1972: p. 24, pl. 5, figs 16, 17 (non Hedley, 1899).

Type material

Holotype (sh) MNHN 24836.

Type locality

Fiji Islands - Musorstom 10, N/O "Alis": Stn CP 1366, S of Viti Levu, 149-168 m, 18°12.4′S, 178°33.1′E, Bouchet, Richer, ORSTOM leg. 15/8/98.

Material examined

The holotype and North Sulawesi, off Menado, S side of Bunaken & Siladen Islets Indonesia, (1°36.2′ N, 124°46.0′ E), 5-20 m, rubble of steep coral slope (1 sh), LACM 88-55; the fossil species *Fartulum* aff. *amputatum* Ladd, 1972 *non* Hedley, 1899 (USNM 650432 and USNM 650433).

Description

Tube slightly subcylindrical with perfectly parallel dorsal and ventral sides in the central area of the adapical portion, where it bends noticeably toward its ventral side. Tube smooth, except for the minute growth lines and longitudinal microsculpture, which are only visible at high magnification. Septum dome-shaped, slightly raised over the cutting plane. The aperture of the tube shows a remarkable ring at the edge, thicker on the dorsal side and crossed by 5 axial rings. Colour ivory-white in beached specimens. Protoconch, operculum and soft parts unknown. Dimensions of the holotype: length 2.3 mm; min. diam. 0.4 mm, max. diam. 0.5 mm.

Etymology

The name is derived from the original human settlers of the Polynesian region, belonging to the ancient Lapita-age ceramics (lapita = a type of fired pottery), coming from Papua - New Guinea or some other regions of Austronesia. This epithet is used here as a noun in apposition.

Distribution

The new species is known only from the type locality, S of Viti Levu, Fiji Islands.

Remarks

This new species is unique, though it presents some similarities with *C. uvea* n. sp. in terms of shape of the apertural ring. However, the bending of the adapical portion of the tube and its much more oblique aperture, confers to this species a more contracted shape in comparison with *uvea*. Furthermore, in *lapita* the tube is much more subcylindrical and shows an indistinct microsculpture (**Fig. 10D**), while in *uvea* the tube is characterised by parallel and equidistant growth lines (**Fig. 14Q**), not visible in the former. The small irregular pitting visible on the tube of *uvea* (**Fig. 10D**), in our opinion have been made by predators. The fossil specimens figured by Ladd (1972) as *Fartulum* aff. *amputatum* Ladd, 1972 (USNM 650432 and USNM 650433) are suspected to belong to the new species.

Caecum amamiense (Habe, 1978) (Fig. 10E)

Fartulum amamiensis Habe, 1978: pl. 1, figs 7-9.

Type material

Holotype, Mo 55444, 2 paratypes, Mo 55445a and Mo 55445b, all in NMNS.

Type locality

Tsuchihama, Tatsugo-Cho, Amami-Oshima, S of Kyushu.

Material examined

The type material and Vauban 1976, New Caledonia: Stn 40, 250-350 m, 1 sh; Exp. Montrouzier Sept. '93, New Caledonia, Touho Sector East coast: Stn 1269, 15-20 m, 1 sh; Stn 1271, 5-25 m, 3 sh; Stn 1272, 10 m, 2 sh; Musorstom 10, Fiji Islands: Stn DW 1381, 275-430 m, 19 sh; Stn CP 1354, 959-963 m, 1 sh; Stn CP 1366, 149-168 m, 2 sh; Stn CP 1369, 392-433 m, 1 sh; Atelier Lifou 2000, Loyalty Islands: Stn 1453, 21-30 m, 1 sh; Santo Marine Biodiversity Survey 2006, Vanuatu Islands: Stn FB 83, 8-20 m, 1 sh; AMS: Fiji Islands: C415366 - n. 000430D, Viti Levu, Nadi Bay (Tomba Ko Nandi), 17°44.000′ S, 177°25.000′ E, 9-35 m, 1 sh; C415371 - n. 000431C, Viti Levu, Vunda Point, between Lautoka and Nadi, 17°41.000′ S, 177°23.000′ E, under coral rubble, 1 sh; other material: Australia, Queensland, ex diving N of Green Is. E of Cairns, 8-11 m, 5 sh (MP); Papua- New Guinea, W. New Britain, Kimbe Bay, Susans Reef, 65 m, ponar grab, 1 sh (BR).

Additional description

Tube smooth, slightly subcylindrical in profile, straighter in the middle. The tube curves more sharply, forming a slight swelling immediately becoming narrower, so determining an almost cutting edge at the aperture. In ventral view, with the septum at the top, the tube shows a slight dextral torsion. Microsculpture consisting of very fine growth lines visible only at high magnification. In frontal view, with the posterior edge turned upwards, the septum appears mucronate, slightly raised over the cutting plane, with a rounded cusp, rotated towards the right side by roughly 30°; anterior margin slightly convex tending to be S-shaped and the posterior one straight. Protoconch, operculum and soft parts unknown. Colour white. Dimensions: mean length: 1.5 mm; mean width: 0.5 mm.

Distribution

Originally described from Japan, it is also found in Queensland (Australia), New Caledonia (southern and eastern zones), Papua - New Guinea, Loyalty Islands, Fiji Islands and Vanuatu Islands.

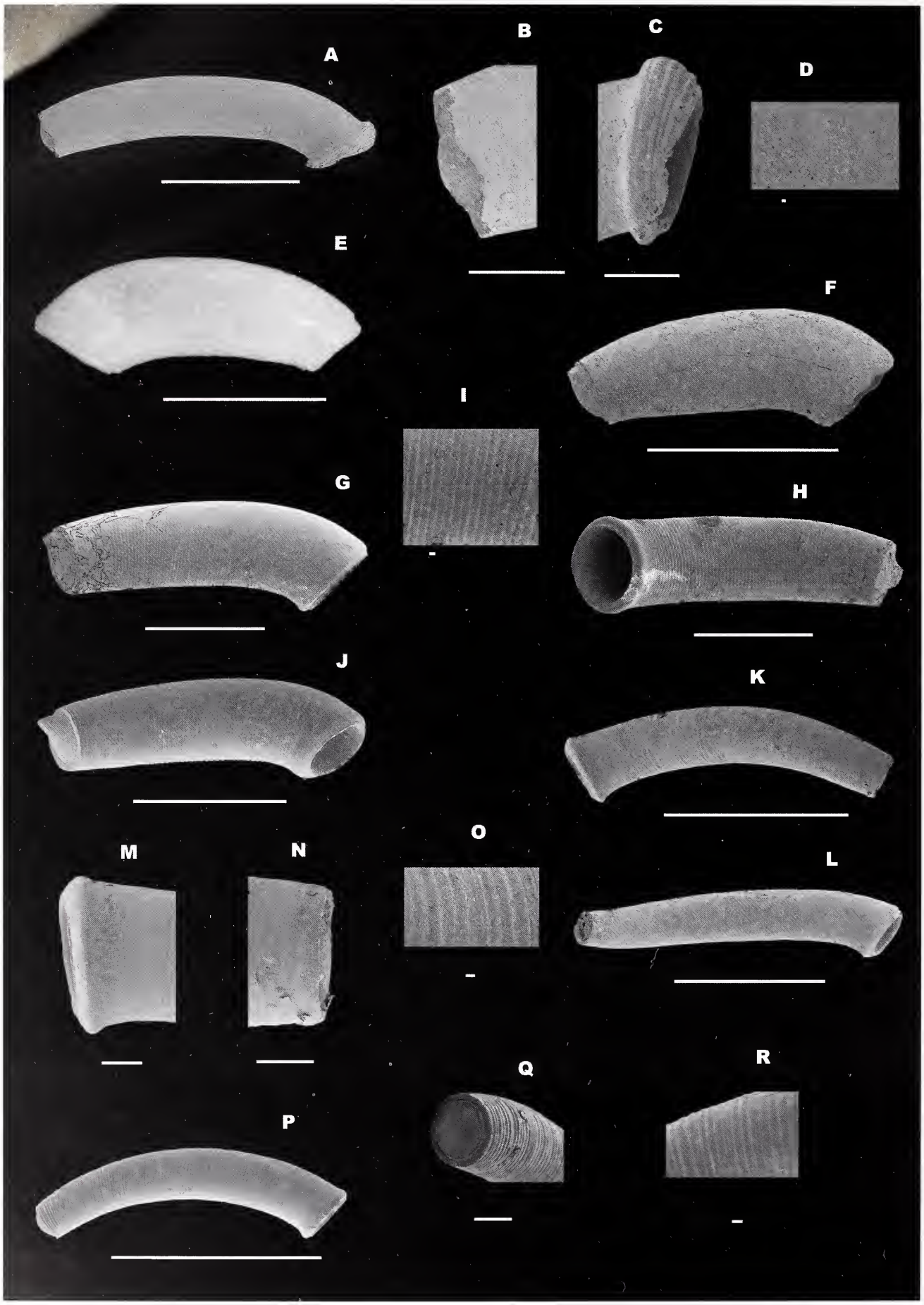
Remarks

C. amamiense shows a distinctive shape, with the dorsal side markedly convex, more than the ventral one, which is almost straight, at least in the central part (**Fig. 10E**). Notwithstanding, some specimens have the anterior diameter visibly smaller than the posterior one, with straight dorsal and ventral profiles, and a clearly abrupt change of direction near the aperture (**Fig. 10F**). The shape of its profile greatly resembles that of the caraibic *C. clava* Folin, 1867. The existence of some transitional forms towards the more typical shape, suggests these are only extreme forms of the same species. As for the general shape, *C. amamiense* - like *C. maestratii* n. sp. - closely resembles *C. modestum* Folin, 1868, although the latter is generally more slender. The mucro of *modestum* is slightly more pronounced with a convex ventral margin (**Fig. 14F**), while that of *amamiense* is almost flat, and tends to be S-shaped in adult specimens (**Fig. 10F**). Moreover, the ventral profile of the tube of *modestum* is always slightly curved, while in *amamiense* it is almost straight.

Caecum maestratii n. sp. (Fig. 10G-J)

Type material

Holotype MNHN 24837 from type locality (**Fig. 10G**) and Exp. Montrouzier Sept. '93- New Caledonia, Touho Sector East coast: 1 paratype (sh) MNHN 24838 Stn 1271, Haut-Fond de Tié, 20°52, 7′S, 165°19.5′E, 5-25 m, outfalls, sand on rock slabs; Musorstom 10, Fiji Islands: 4 paratypes (sh) MNHN 24839 Stn DW 1381, S of Viti Levu, 18°17.8′ S, 177°54.4′E, 275-430 m; Santo Marine Biodiversity Survey 2006, Vanuatu Islands:1 paratype (sh) MNHN 24840 Stn DB 20, NW Urélapa Is., 15°30.5′S, 167°01.4′E, sand with coral patches, 22-25 m; 1 paratype (sh) MNHN 24841 Stn DB 61, N Tutuba Is., 15°32.3′S, 167°16.9′E, coral reef, 41 m; 1 paratype (sh) MNHN 24842 Stn FB 64, Tangoa Is., 15°35.4′S, 166°59.2′E.



Mauro Pizzini, Bret Raines & Angelo Vannozzi

Additional material

1 sh (smooth) from Stn DW 1381, S of Viti Levu, 18°17.8'S, 177°54.4'E, 275-430 m, and few lots (all sh) from Fiji Islands and Papua - New Guinea (all BR), 1 sh from Kenya (NMSA - K 7984).

Type locality

Atelier Lifou 2000, Loyalty Islands: Stn 1410, between Cape Wekutr and Cape Wajez, edge of the flats, 20°56.7'S, 167° 03.1'E, 2-4 m.

Description

Tube slightly subcylindrical, in profile with dorsal and ventral sides nearly straight. Near the aperture, the tube curves more sharply, forming a slight swelling which immediately becomes narrower, forming a small ledge or rim. Tube comprised of 51-76 small raised rings (ca. 75 in the holotype), well separated and regular, crossing the entire tube axially; juvenile specimens frequently lack this sculpture, giving the tube a smooth appearence. Tube seemingly without microsculpture except for very fine growth lines, visible only at high magnification. In ventral view, with the septum at the top, the tube shows a slight clockwise axial torsion. Septum mucronate, with a pointed mucro strongly raised over the cutting plane, curved towards the right side by roughly 30°; the anterior margin is slightly convex tending to a S-shape, while the posterior is straight; slightly wavy scars visible in the anterior margin. Protoconch, operculum and soft parts unknown. Colour milk white in beached specimens. Holotype dimensions: length 2.9 mm; diam. min. 0.6 mm, max. 0.8 mm. Paratype dimensions (Santo 2006, Stn DB 20): length 2.0 mm; min. diam. 0.4 mm; max. diam. 0.6 mm.

Distribution

Loyalty Islands, New Caledonia (Touho Sector East coast), Fiji Islands, Vanuatu Islands, Papua - New Guinea and Kenya (NMSA).

Etymology

The new species is named after Philippe Maestrati, a well known malacologist of the staff MNHN.

Remarks

Like *C. amamiense* (Habe, 1978), the general shape of *C. maestratii* greatly resembles *C. modestum* Folin, 1868 **(Fig. 14F)**, although the latter is generally smaller. The mucro of *modestum* is more pronounced and its ventral margin is convex, while the mucro of *maestratii* is almost flat, tending to be S-shaped. Moreover, the ventral profile of the tube of *modestum* is always slightly curved, while the profile of the other species is straight. *C. amamiense* **(Fig. 10E)** also resembles the new species in general shape of the tube, even though its ventral side appears much more to the right, and in the septum typology, more pointed in *maestratii*. The main difference between the two species lies within the sculpture, with *maestratii* having many small raised rings (ca. 74 in the holotype), while in *amamiense* the tube is smooth. One specimen of the new species is smooth **(Fig. 10F)**, probably due to the poor conditions of the shell. However, the straight shape of its ventral side and the S-shaped mucro leave no doubts about the identity of this taxon.

Caecum dakuwaqa n. sp.
(Fig. 10K-O)

Type material

Holotype (sh) MNHN 24843 and 8 paratypes (sh) MNHN 24844 from type locality; Musorstom 8, 1994, Vanuatu Islands: 1 paratype (sh) MNHN 24845 Stn DW 1072, 622-625 m; 15 paratypes (sh) MNHN 24846 Stn DW 1105, 15°03'S, 167°07'E, 154-179 m; Musorstom 10, 1998 Fiji Islands: 2 paratypes (sh) MNHN 24847 Stn DW 1314, Bligh Water, 17°16.1'S, 178°14.8'E, 656-660 m; 8 paratypes (sh) MNHN 24848 Stn DW 1333, Bligh Water, 16°50.4'S, 178°12.5'E, 200-215 m; 2 paratypes (sh)

Fig. 10. A. *Caecum lapita* n. sp., holotype MNHN, Stn CP 1366 (scale bar = 1 mm). L = 2.44 mm. **B.** *C. lapita* n. sp., holotype MNHN, Stn CP 1366, septum (scale bar = 200 µm). **C.** *C. lapita* n. sp., holotype MNHN, Stn CP 1366, aperture (scale bar = 200 µm). **D.** *C. lapita* n. sp., holotype MNHN, Stn CP 1366, microsculpture (scale bar = 10 µm). **E.** *C. amamiense* (Habe, 1978), holotype NSMN (scale bar = 1 mm). L = 2 mm. **F.** *C. maestratii* (Habe, 1978), Stn DW 1381 (scale bar = 1 mm). L = 1.7 mm. **G.** *C. maestratii* n. sp., holotype MNHN, Stn 1410 (scale bar =1 mm). L = 2.7 mm. **H.** *C. maestratii* n. sp., holotype MNHN, Stn 1410, ventral view (scale bar = 1 mm). **I.** *C. maestratii* n. sp., holotype MNHN, Stn 1410, microsculpture (scale bar = 20 µm). **J.** *C. maestratii* n. sp., paratype MNHN, Santo 2006, Stn DB 20 (scale bar = 1 mm). L = 2.15 mm. **K.** *C. dakuwaqa* n. sp., holotype MNHN, Stn DW 1384 (scale bar = 1 mm). L = 1.8 mm. **L.** *C. dakuwaqa* n. sp., paratype MNHN, Stn DW 1384, ventral view (septum broken), (scale bar = 1 mm). L = 2.2 mm. **M.** *C. dakuwaqa* n. sp., holotype MNHN, Stn DW 1384, aperture (scale bar = 100 µm). **Fig. 10. N.** *C. dakuwaqa* n. sp., holotype, MNHN Stn DW 1384, septum (scale bar = 100 µm). **O.** *C. dakuwaqa* n. sp., holotype MNHN, Stn DW 1384, microsculpture (scale bar = 20 µm). **P.** *C. fijiense* n. sp., holotype MNHN, Stn DW 1333 (scale bar = 1 mm). L = 1.5 mm. **Q.** *C. fijiense* n. sp., holotype MNHN, Stn DW 1333, septum (scale bar = 100 µm). **R.** *C. fijiense* n. sp., holotype MNHN, Stn DW 1333, microsculpture (scale bar = 20 µm).

Fig. 10. A. *Caecum lapita* n. sp., olotipo MNHN, Stn CP 1366 (scala = 1 mm). L = 2,44 mm. **B.** *C. lapita* n. sp., olotipo MNHN, Stn CP 1366, setto (scala = 200 µm). **C.** *C. lapita* n. sp., olotipo MNHN, Stn CP 1366, apertura (scala = 200 µm). **D.** *C. lapita* n. sp., olotipo MNHN, Stn CP 1366, microscultura (scala = 10 µm). **E.** *C. amamiense* (Habe, 1978), olotipo NSMN (scala = 1 mm). L = 2 mm. **F.** *C. maestratii* (Habe, 1978), Stn DW 1381 (scala = 1 mm). L = 1,7 mm. **G.** *C. maestratii* n. sp., olotipo MNHN, Stn 1410 (scala =1 mm). L = 2,7 mm. **H.** *C. maestratii* n. sp., olotipo MNHN, Stn 1410, vista ventrale (scala = 1 mm). **I.** *C. maestratii* n. sp., olotipo MNHN, Stn 1410, microscultura (scala = 20 µm). **J.** *C. maestratii* n. sp., paratipo MNHN, Santo 2006, Stn DB 20 (scala = 1 mm). L = 2,15 mm. **K.** *C. dakuwaqa* n. sp., olotipo MNHN, Stn DW 1384 (scala = 1 mm). L = 1,8 mm. **L.** *C. dakuwaqa* n. sp., paratipo MNHN, Stn DW 1384, vista ventrale (setto rotto), (scala = 1 mm). L = 2,2 mm. **M.** *C. dakuwaqa* n. sp., olotipo MNHN, Stn DW 1384, apertura (scala = 100 µm). **N.** *C. dakuwaqa* n. sp., olotipo, MNHN Stn DW 1384, setto (scala = 100 µm). **O.** *C. dakuwaqa* n. sp., olotipo MNHN, Stn DW 1384, microscultura (scala = 20 µm). **P.** *C. fijiense* n. sp., olotipo MNHN, Stn DW 1333 (scala = 1 mm). L = 1,5 mm. **Q.** *C. fijiense* n. sp., olotipo MNHN, Stn DW 1333, setto (scala = 100 µm). **R.** *C. fijiense* n. sp., olotipo MNHN, Stn DW 1333, microscultura (scala = 20 µm).

MNHN 24849 Stn DW 1334, Bligh Water, 16°51.4′S, 178°13.9′E, 251-257 m; 3 paratypes (sh) MNHN 24850 Stn DW 1365, S of Viti Levu, 18°12.7′S, 178°32.4′E, 295-302 m; 1 paratype (sh) MNHN 24851 Stn DW 1376, S of Viti Levu, 18°18.4′S, 178°09.1′E, 497-504 m; 2 paratypes (sh) MNHN 24852 Stn DW 1381, S of Viti Levu, 18°17.8′S, 177°54.4′E, 275-430 m, 2 paratypes (sh) MNHN 24853 Stn CP 1354, S of Viti Levu, 17°42.6′S, 178°55.0′E, 959-963 m; 4 paratypes (sh) MNHN 24854 Stn CP 1363, S of Viti Levu, 18°12.4′S, 178°33.0′E, 144-150 m; 9 paratypes (sh) MNHN 24855 Stn CP 1366, S of Viti Levu, 18°12.4′S, 178°33.1′E, 149-168 m; 14 paratypes (sh) MNHN 24856 Stn CP 1369, S of Viti Levu, 18°11.1′S, 178°23.4′E, 392-433 m.

Type locality

Musorstom 10, 1998, Fiji Islands: Stn DW 1384 SE of Viti Levu, 260-305 m, 18°18.5′S, 178°05.8′E.

Description

Tube clearly subcylindrical, with a spiral torsion on two levels, like a *Parastrophia*. Holding the shell with the ventral side toward the observer and the septum at the top, the tube shows a dextral coiling ending with an aperture diagonally inclined to the left by roughly 30° with respect to the axis. Sculpture consisting of about 60 small rings, although not always found on all the specimens. Septum slightly hemispherical, with traces of temporary septum, nearly flat, always hidden below the cutting plane. The tube rapidly becomes wider near the opening forming a kind of ring in which diameter resembles a cusp in profile; then the ring becomes narrower forming a perfectly round aperture. Protoconch, operculum and soft parts unknown. Whitish in beached specimens. Dimensions of the holotype: mean length 2.2 mm; min. diam. 0.2 mm, max. diam. 0.4 mm.

Distribution

This species is currently known only from the Fiji Islands, in 144-963 m.

Etymology

This epithet takes its name from the Shark God of a Fijian legend. He is the guardian of the entrance of the reef. This epithet is used here as a noun in apposition.

Remarks

C. dakuwaqa (**Fig. 10K-O**) is a peculiar species, different from any other caecid known in the area, due to its clear double torsion. All the specimens have been found at depths greater than 100 m. Considering that caecids usually live in shallow water, typically not deeper than 70 m, we assume that the shells of *C. dakuwaqa* were transported down-slope from shelf bottoms. *C. dakuwaqa* resembles *C. campanulatum* Raines & Pizzini, 2005 (**Fig. 11A**), having in common the same widening near the aperture, stronger in *dakuwaqa*, and the same type of sculpture, consisting of small rings. They differ in the septum, being more recessed in *dakuwaqa* (**Fig. 10N**), in the general shape of the tube, more cylindrical in *campanulatum*, and above all in the lack of the spiral torsion in the latter, a constant and unique characteristic of *C. dakuwaqa* (**Fig. 10L**). As for the similarities with *C. fijiense* n. sp., see below.

Caecum fijiense n. sp.
(Figs 10P-R, 19A)

Type material

Holotype (lv) MNHN 24857 and 33 paratypes (4 lv and 29 sh) MNHN 24858 from type locality; 4 paratypes (sh) MNHN 24859 Stn DW 1376, S of Viti Levu, 18°18.4′S, 178°09.1′E, 497-504 m; 1 paratype (sh) MNHN 24860 Stn DW 1384, SE of Viti Levu, 18°18.5′S, 178°05.8′E, 260-305 m.

Type locality

Musorstom 10 1998, Fiji Islands: Stn DW 1333, Bligh Water, 16°50.4′S, 178°12.5′E, 200-215m.

Material examined

Musorstom 10 1998, Fiji Islands: Stn DW 1381, 275-430 m, *C.* cf. *fijiense* juv. 1 sh.

Description

Tube clearly subcylindrical, covered by about 85 marked small rings, slightly raised and very close to each other; some rare specimens are completely smooth or with obsolete and narrow, ill defined rings. Septum dome-shaped, without mucro, slightly protruded over the cutting plane. Aperture perfectly circular. Operculum corneous, showing the external surface with 6 thin concentric rings from the edge towards the nucleus and bordered by a seemingly smooth area; internal surface with similar sculpture. Protoconch and soft parts unknown. Dimensions: length 1.6 mm; min. diam. 0.2 mm, max. diam. 0.3 mm.

Distribution

This species is currently known only from the Fiji Islands in 200-504 m, sh only.

Etymology

The name is from Fiji Islands, its type locality.

Remarks

C. fijiense (**Fig. 10P**) resembles very much *C. campanulatum* (**Fig. 11A**), in the shape of the tube, the sculpture, the septum and the aperture, nevertheless *fijiense*

has a more slender and subcylindrical tube, a more protruding septum, much more pronounced rings and a clearer widening of the aperture. *C. fijiense* also shows some similarities with *C. dakuwaqa* (**Fig. 10K-O**), having the same shape of the tube, but differing mainly in the non-twisted tube, and in the more protruding septum.

Caecum* cf. *campanulatum Raines & Pizzini, 2005
(Fig. 11B)

Type material

Holotype, LACM 3027, from type locality (**Fig. 11A**).

Type locality

In sand collected along the base of cliffs at 20 m, off Hanga Nui, Easter Is., Chile, 27°07′46″S, 109°16′35″W.

Material examined

The type material and Musorstom 10, Fiji Islands: Stn DW 1381, 275-430 m, 1 sh (**Fig. 11B**).

Additional description

Tube slightly arched, slender, with the abapical portion somewhat smaller than the adapical. The tube widens slightly near the aperture showing a silhouette closely resembling that of a bell, then quickly narrowing once again and ending with a sharp edge. Microsculpture quite obsolete and scarcely visible, even at high magnification, while the sculpture would appear to consist of rings, which are also barely observable, though they are more visible near the aperture. Septum dome-shaped, scarcely raised over the cutting plane. Aperture circular. Colour translucent, with faint axial brown wavy lines. Protoconch, operculum and soft parts unknown. Dimensions of the specimen from Fiji Islands, Stn DW 1381: length 1.4 mm; diam. 0.3 mm.

Distribution

Originally described from Easter Is., its distribution is herein extended to Fiji Islands, at least provisionally.

Remarks

The single specimen of this species (**Fig. 11B**) is slightly different from those from Easter Is. (holotype **Fig. 11A**), because septum and apertural varix are a little more protruding and the annulated sculpture is vanishing.

Caecum* cf. *folini Kisch, 1959
(Figs 11C, D, 19B)

Caecum eburneum Folin, 1886: p. 688, pl. 50, fig. 9.
Caecum folini Kisch, 1959a: p. 329 (*nom. nov. pro C. eburneum* Folin, 1886, *non* C.B. Adams, 1852).

Type material

Not seen.

Type locality

Stn 186: 10°30′S, 142°18′E Wednesday Island, Cape York (Northern Australia), 8 fathoms.

Material examined

C. eburneum Folin, 1886, lectotype of *C. folini* Kisch, 1959: NHMUK 1887.2.9.2365 (**Fig. 11F, G**); Exp. Montrouzier Sept. '93 - New Caledonia, Touho Sector East coast: Stn 1260, 49-59 m, 4 sh; Exp. Montrouzier Oct. '93 - New Caledonia, Koumac Sector NW: Stn 1277, 0-2 m, 1 sh (short form); Stn 1292, tide, soft bottoms, *C.* cf. *folini*, 5 sh; Stn 1310, 15 m, 1 sh; Musorstom 10 1998, Fiji Islands: Stn DW 1314, 656-660 m, 1 sh; Stn DW 1381, 275-430 m, *C.* cf. *folini* 1 sh (broken); Atelier Lifou 2000, Loyalty Islands: Stn 1412, 2-5 m, 1 lv (broken); Stn 1422, 4 m, 1 sh; Stn 1429, 8-18 m, *C.* cf. *folini* 1 sh (juv., two stages still attached); Stn 1430, 20-25 m, 1 lv; Stn 1456, 25-30 m, 1 lv.

Additional material

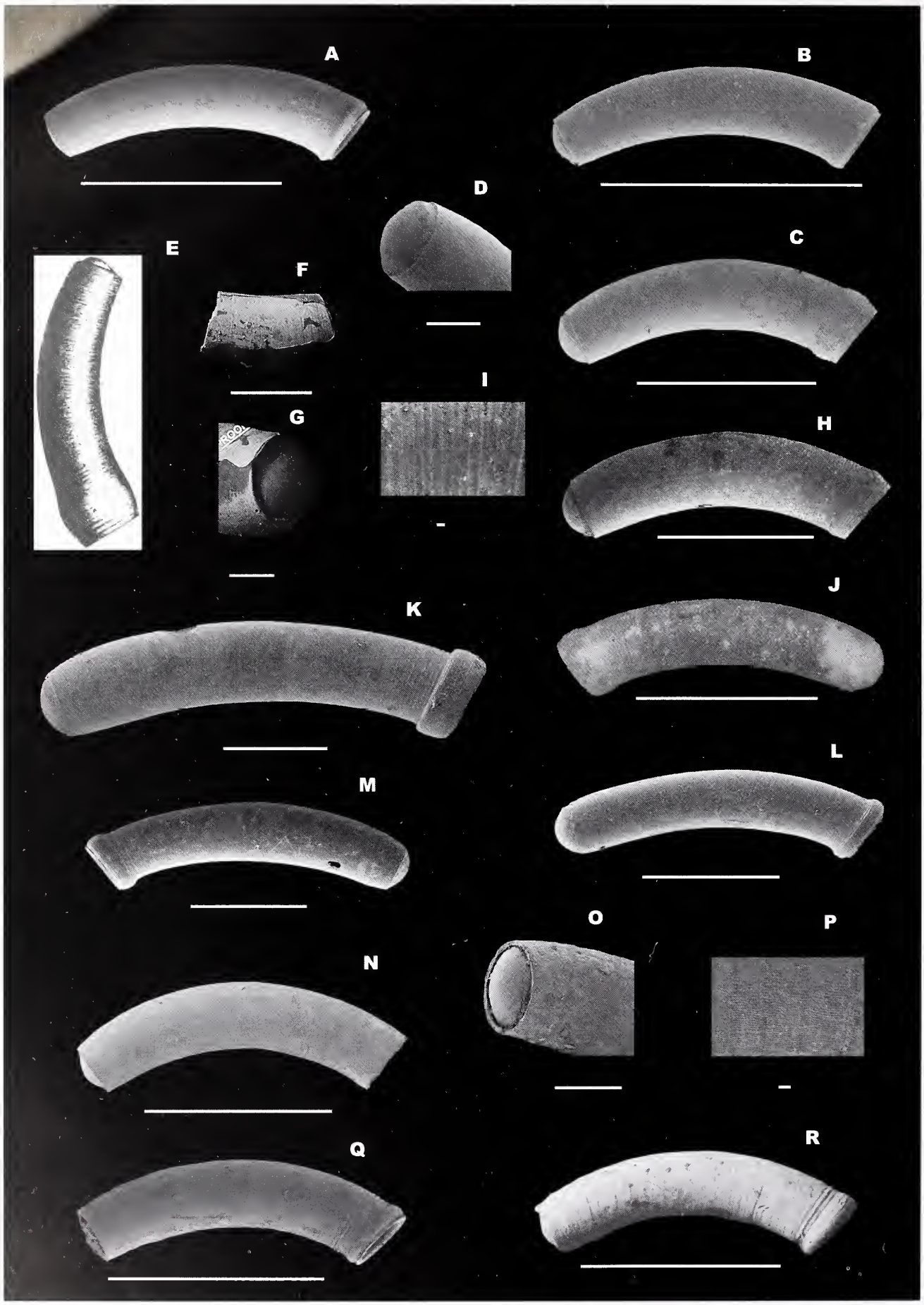
Few lots (all sh) from Japan and Papua - New Guinea (all BR).

Additional description

Tube cylindrical, crossed by fine growth striation, more evident near the aperture, sometimes assuming the shape of small, usually indistinct and slightly raised rings; interspaces nearly smooth and with irregular longitudinal striae. Septum protruded, mucronate, with a small lateral appendage turned to the right side at about 30°, usually slightly visible above the cutting plane. Aperture edged by a swelling, crossed by small rings which smoothly tighten, forming an additional striated portion of tube. Apertural ring comprised of a more or less pronounced varix, crossed by microscopic rings. Operculum light brown, external surface crossed by 9-10 small concentric rings and a central portion smooth and slightly depressed; internal surface containing 6-7 fine, concentric, regular rings; nucleus smooth and raised. Colour white. Protoconch and soft parts unknown. Dimensions: length 1.9 - 2.2 mm; min. diam. 0.38 mm, max. diam. 0.5 mm.

Distribution

Originally described from Wednesday Island, Cape York (Northern Australia), and recorded by Kisch (1959a) from the East China Sea and Japan. Its geographical distribution is here expanded to include New Caledonia, Loyalty Islands, Fiji Islands, Papua - New Guinea, Samoan Islands.



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Remarks

The name *C. eburneum* Folin, 1886 is previously occupied by *C. eburneum* C.B. Adams, 1852, from Panama; therefore, Kisch (1959a: p. 329) proposed the *C. folini* as *nomen novum*.
The holotype of *C. eburneum* in NHMUK is broken and completely unrecognizable (**Fig. 11F, G**); Kisch cites other 28 specimens from Japan and about 50 from the East China Sea, whose repository is unknown, hence our identification is only based on the original descriptions and illustrations.

Caecum gulosum Hedley, 1899
(Fig. 11H, J)

Caecum gulosum Hedley, 1899a: p. 426, fig. 16.

Type material

C. gulosum Hedley, 1899, holotype AMS n. C5919, sh (**Fig. 11J**).

Type locality

Atoll of Funafuti, Ellice Group.

Material examined

The type material and Bathus 1, 1993 - New Caledonia, East coast: Stn DW 1233, 45-50 m, 1 sh; Exp. Montrouzier Sept. '93 - New Caledonia, Touho Sector East coast: Stn 1264, 8 m, 1 sh; Exp. Montrouzier Oct. '93 - Nouvelle Calédonie, Secteur de Koumac NW: Stn 1277, 0-2 m, 1 sh.

Additional description

Tube slightly arched, cylindrical, crossed by fine growth striae, sometimes more pronounced, rough and poorly defined. Tube ending with a circular aperture, edged by a ring-shaped thickening, crossed by 4-5 small rings, slightly raised and indistinct. Septum dome-shaped with a small tongue-like mucro oriented to the right side. Protoconch, operculum and soft parts unknown. Colour white. Dimensions: length 1.8 mm, diam. 0.4 mm.

Distribution

Pacific Ocean: Funafuti Is. (Ellice Group) (Hedley, 1899a); Hong Kong (Port Is.) (Hugues, 1985a); Society Islands (Tröndlé & Boutet, 2009). Herein we extend geographical distribution to New Caledonia, Touho Sector.

Remarks

Only 3 specimens were found that fit perfectly with the original description and drawing (**Fig. 11H**). We believe that the "...two rough ring ridges" on the mucro, reported by Hedley are simply calcareous encrustations erroneously interpreted by the author.
The differences between *folini* and *C. gulosum* are subtle: *folini* is smaller and more delicate, but shows a much more pronounced varix despite its frail appearance. In *folini* the sculpture consists of rings thinner than in *gulosum*, and are more concentrated in the portion near the aperture. Interspaces are smooth in *folini*, while in *gulosum* they have fine and regular longitudinal striations (**Fig. 11I**).

Caecum loyaltense n. sp.
(Fig. 11K)

Type material

Holotype (sh) (Fig. 11K) MNHN 24861 from type locality and 1 paratype (sh) MNHN 24862 Stn 1448, Loyalty Islands, N of Cape Aimé Martin [= Acadro], vacuum dredge, hard bottom, 20°45.8'S, 167° 01.65'E, 20 m; Santo Marine Biodiversity Survey, 2006, Vanuatu Islands: 1 paratype (sh) MNHN 24863 Stn FS 77, Segond Channel, NW Aoré Is., 15°33.1'S, 167°09.6'E, coral patches on step wall, 29 m

Fig. 11. A. *Caecum campanulatum* Raines & Pizzini, 2005, holotype LACM 3027 (scale bar = 1 mm). L = 1.6 mm. **B.** *C.* cf. *campanulatum* Raines & Pizzini, 2005, Stn DW 1381 (scale bar = 1 mm). L = 1.3 mm. **C.** *C.* cf. *folini* Kisch, 1959, Stn 1260 (scale bar = 1 mm). L = 1.8 mm. **D.** *C.* cf. *folini* Kisch, 1959, Stn 1260, septum (scale bar = 200 μm). **E.** *C. folini* Kisch, 1959, orig. fig. **F.** *C. eburneum* Folin, 1886, holotype, NHMUK 1887.2.9.2365 (scale bar = 500 μm). **G.** *C. eburneum* Folin, 1886, holotype NHMUK, septum (scale bar = 200 μm). **H.** *C. gulosum* Hedley, 1899, Stn 1277, (scale bar = 1 mm). L = 2.1 mm. **I.** *C. gulosum* Hedley, 1899, Stn 1277, microsculpture (scale bar = 20 μm). **J.** *C. gulosum* Hedley, 1899, holotype AMS C5919, Atoll of Funafuti, Ellice Group (scale bar = 1 mm). L = 1.8 mm. **K.** *C. loyaltense* n. sp., holotype MNHN, Stn 1442 (scale bar = 1 mm). L = 4.3 mm. **L.** *C. kontiki* Pizzini & Raines, 2011, Stn 1462 (scale bar = 1 mm). L = 2.4 mm. **M.** *C. kontiki* Pizzini & Raines, 2011, holotype MNHN 22068, Tahiti (Society Islands), Tiarei (scale bar = 1 mm). L = 2.8 mm. **N.** *C.* cf. *glabellum* (Carpenter *in* Adams, 1868), Stn 1432 (scale bar = 1 mm). L = 1.8 mm. **O.** *C.* cf. *glabellum* (Carpenter *in* Adams, 1868), Stn 1432, septum (scale bar = 200 μm). **P.** *C.* cf. *glabellum* (Carpenter *in* Adams, 1868), Stn 1432, microsculpture (scale bar = 10 μm). **Q.** *C. succineum* Folin, 1880, Stn 1312, (scale bar = 1 mm). L = 1.5 mm. **R.** *C. succineum* Folin, 1880, lectotype NHMUK 1887.2.9.2344 (scale bar = 1 mm). L = 1.6 mm.

Fig. 11. A. *Caecum campanulatum* Raines & Pizzini, 2005, olotipo LACM 3027 (scala = 1 mm). L = 1,6 mm. **B.** *C.* cf. *campanulatum* Raines & Pizzini, 2005, Stn DW 1381 (scala = 1 mm). L = 1,3 mm. **C.** *C.* cf. *folini* Kisch, 1959, Stn 1260 (scala = 1 mm). L = 1,8 mm. **D.** *C.* cf. *folini* Kisch, 1959, Stn 1260, setto (scala = 200 μm). **E.** *C. folini* Kisch, 1959, fig. orig. **F.** *C. eburneum* Folin, 1886, olotipo, NHMUK 1887.2.9.2365 (scala = 500 μm). **G.** *C. eburneum* Folin, 1886, olotipo NHMUK, setto (scala = 200 μm). **H.** *C. gulosum* Hedley, 1899, Stn 1277, (scala = 1 mm). L = 2,1 mm. **I.** *C. gulosum* Hedley, 1899, Stn 1277, microscultura (scala = 20 μm). **J.** *C. gulosum* Hedley, 1899, olotipo AMS C5919, Atollo di Funafuti, Gruppo delle Isole Ellice (scala = 1 mm). L = 1,8 mm. **K.** *C. loyaltense* n. sp., olotipo MNHN, Stn 1442 (scala = 1 mm). L = 4,3 mm. **L.** *C. kontiki* Pizzini & Raines, 2011, Stn 1462 (scala = 1 mm). L = 2,4 mm. **M.** *C. kontiki* Pizzini & Raines, 2011, olotipo MNHN 22068, Tahiti (Isole della Società), Tiarei (scala = 1 mm). L = 2,8 mm. **N.** *C.* cf. *glabellum* (Carpenter *in* Adams, 1868), Stn 1432 (scala = 1 mm). L = 1,8 mm. **O.** *C.* cf. *glabellum* (Carpenter *in* Adams, 1868), Stn 1432, setto (scala = 200 μm). **P.** *C.* cf. *glabellum* (Carpenter *in* Adams, 1868), Stn 1432, microscultura (scala = 10 μm). **Q.** *C. succineum* Folin, 1880, Stn 1312, (scala = 1 mm). L = 1,5 mm. **R.** *C. succineum* Folin, 1880, lectotipo NHMUK 1887.2.9.2344 (scala = 1 mm). L = 1,6 mm.

Type locality

Atelier Lifou 2000, Loyalty Islands: Stn 1442, Santal Bay, Cape Aime Martin (= Acadro), 20°46.4'S, 167°02.0'E, bottom of outfall, 47 m.

Additional material

Few lots (all sh) from Japan and Maldive Islands (all BR).

Description

Shell large, slightly arched. Adapical portion of the tube clearly subcylindrical, the remaining perfectly cylindrical, until the aperture, crossed by about 64-67 rough, very small rings, more visible in its abapical portion. Longitudinal microsculpture very fine, barely visible. Mucro very small, slightly raising bejond the cutting plane, hemispherical, with a very small appendage, hardly visible, turned to the right side. Aperture, perfectly circular surrounded by a strong varix with parallel sides, covered by 10-12 very small rings. Colour white. Protoconch, operculum and soft parts unknown. Holotype dimensions: length 3.9 mm, diam. min. 0.6 mm, diam. in the middle of the tube 0.72 mm, max. diam. 0.88 mm.

Distribution

This species is currently known from type locality, Indian Ocean (Maldive Islands) (MP) and North-West Pacific (Okinawa Is., Japan) (BR).

Etymology

The new species takes its name from the Loyalty Islands, the area of the type locality.

Remarks

C. loyaltense (**Fig. 11K**) is similar to *C. gulosum* Hedley, 1899a (**Fig. 11J**), both sharing the same type of septum. However, the new species differs by a different shape of the apertural ring; besides the tube of *loyaltense* is twice as large. The paratype, a subadult specimen, is slightly different from the holotype, adult, having a more protruded mucro, the tube crossed only by growth striation and a longitudinal indistinct microsculpture, more visible than in the adult.

Caecum kontiki Pizzini & Raines, 2011 (Fig. 11L, M)

Caecum kontiki Pizzini & Raines, 2011: p. 28, fig. 2G, H.

Type material

Holotype (sh), MNHN 22068 (**Fig. 11M**).

Type locality

Tahiti (Society Islands), Tiarei, fringing reef, shell grit under rocks.

Material examined

The type material and Santo Marine Biodiversity Survey, 2006 - Vanuatu Islands: Stn DS 99, NW Tutuba Is., 15°32.5'S, 167°16.9'E, caves and holes with sand pockets, 100-105 m, 1 sh; Atelier Lifou 2000, Stn 1462, Loyalty Islands, Lifou, Santal Bay, at the SE end of Point Aime Martin (= Acadro), 20°47.1'S, 167° 03.2'E, dredgings, 70-120 m, 1 sh (**Fig. 11L**).

Additional material

One lot (sh) from Society Islands (Tahiti) (JL).

Additional description

Tube gradually subcylindrical, slender, having very fine growth striae becoming thin, obsolete rings near the aperture and a vanishing longitudinal striation, only visible at high magnification. Septum dome-shaped, rather protruding over the cutting plane, with a very small indistinct mucro turned towards the dorsal side. Aperture surrounded by a varix crossed by 5-6 minute obsolete rings, though not always detectable. Colour whitish. Protoconch, operculum and soft parts unknown. Dimensions of the specimen from Stn 1462: length: 2.4 mm.

Distribution

This species was originally described from Society Islands (Tahiti Is.). Its geographical distribution is herein extended to Loyalty Islands.

Remarks

C. kontiki (**Fig. 11L-M**) differs from *C. loyaltense* n. sp. (**Fig. 11K**) due to its smaller size, the slowly twisted tube and the different shape of the apertural ring, evenly rounded in the former, compressed in the latter. Furthermore, *C. loyaltense* has a more continuous ringed sculpture along the entire tube, and a larger ring with flat sides. *C. kontiki* is similar to *C. gulosum* (**Fig. 11J**) in general shape, with the main differences between the two species consisting of a less protruding dome-shaped septum and a more rounded apertural ring in *kontiki*. In addition, *gulosum* has fine close threads in the abapical portion of the tube, while the sculpture of *kontiki* consists only of few very small rings.

Caecum cf. *glabellum* (Carpenter in Adams, 1868) (Figs 11N, P, 19C)

Brochina (? *var.*) *glabella* Adams A., 1868: p. 3.

Type material

Not found.

Type locality

Akasi and Tanabe (Japan).

Material examined

Bathus 2, New Caledonia: Stn CP 755, 495 m, 1 sh; Atelier Lifou 2000, Loyalty Islands: Stn 1412, 2-5 m, 1 lv; Stn 1432, 12-32 m, 1 lv (**Fig. 11N-P**); Exp. Musorstom 1994, Vanuatu Islands: Stns CP 1131-1132, 140-182 m, 1 sh; Musorstom 10 1998, Fiji Islands: Stn CP 1353, 879-897 m, 1 sh.

Additional description

Tube rather arched and perfectly cylindrical until the aperture then weakly contracted; surface smooth, sometimes with irregular growth striae, particularly in the adapical portion, appearing as longitudinal worm-like microsculpture, visible at low magnification. Septum perfectly hemispherical, ranging in appearance from nearly flat, without any type of mucro, to slightly protruded over the cutting plane with traces of a temporary septum. Operculum corneous, light brown, having external surface sculptured by 4-5 concentric small rings, from the border toward the center; internal surface quite similar to the external (**Fig. 19C**). Colour whitish. Protoconch and soft parts unknown. Dimensions: length: 1.4 mm; diam. 0.3 mm.

Distribution

Originally described from Japan, *Caecum glabellum* (Carpenter in Adams, 1868) is dubitatively reported by Kay (1979: p. 110, fig. 42G) from the Hawaiian Islands, Hugues (1985a) quotes it among the malacofauna of Hong Kong and Bandel (1996: pp. 55, 56, 59, pl. 2, figs 1-3) reports it from the Red Sea. Morton et al. (1998) include it among the "representative components of the fauna coral of algal turf" of the Azores Islands. It is here reported for the first time in New Caledonia, Vanuatu Islands, Loyalty Islands and Fiji Islands.

Remarks

In the introductory part of his work, Adams (1868: p. 2) states to have not identified any of the new species among the Caecidae from Japan, but rather sent them to Carpenter for classification, recognizing him as having a greater knowledge on this family and annotated it in the comments ("His results will now be given in his own words"). The original description of this species is very short but sufficiently clear, especially with regards to the shape of the septum, at the beginning defined "*B. glabrae simillima...*", so having a septum completely void of any type of appendage and subsequently "*... septum parum convexo, subplanato, apice inconspicuo*", where the last Latin word means scarcely visible, so confirming our diagnosis. Most recently *C. glabellum* has been figured by some authors (i.e. Habe, 1953; Kay, 1979; Hugues, 1985a,b; Shigetomi, 1990), endowed with a well visible mucro, which is completely different from the characteristics noted in original description. We only partially agree with Bandel who shows an adult specimen of *C. glabellum* (1996: p. 95, pl. 3, fig. 1), whereas in every other detail of this species, in particular the juvenile specimen from Red Sea (pl. 3, fig. 3) he shows a shell with a septum more similar to that of *C. auriculatum* Folin, 1868 (an endemic Mediterranean species), well developed with an obvious mucro. On the other hand he shows, noticeably in the supposed protoconch of this species (pl. 2, fig. 5) the longitudinal striation also present in the adult of the New Caledonian specimens (**Fig. 11P**). Lightfoot (1992b: p. 3, fig. 6) also figured two specimens, an adult and a juvenile from Kauai (Hawaiian Islands) giving them the name "*Caecum* (*Brochina*) cf. *glabella* A. Adams, 1868", from a previous analysis by Kay (1979: p. 110, fig. 42G) having a mucronate septum, well developed with an appendage ("rounded tongue-like projection"), a morphological character not observed by us, or within Adams' brief description. However, *Caecum* (*Brochina*) cf. *glabellum* (A. Adams, 1868) *sensu* Lightfoot fits very well to another species, which we identified as *C. mauritianum* (**Figs 13I-K**). Hasegawa illustrates a shell (2000: p. 170, figs 6, 6a-b), which also does not agree with *C. glabellum*.

Among the examined material we found shells fitting well the synthetic description of *C. glabellum*. However, it has not been possible to compare these shells with the original material, because it has been impossible to locate it in any of the consulted museums. We therefore consider the type material to be lost. We will abstain for the time being from proposing a neotype for *C. glabellum*, hoping to return in the future on this matter with additional material, to show what in our opinion is *C. glabellum*.

Caecum succineum Folin, 1880
(Figs 11Q, R, 12A-C, 19I)

Caecum succineum Folin, 1879 (1880): p. 810.
Caecum succineum Folin, 1881: tome 4, chap. 9, p. 25, pl. 2, figs 12, 13.
Caecum succineum Folin, 1886: pp. 685-686, pl. 3, figs 15, 16.
Caecum sp. a Bosch et al., 1995: p. 49, n. 144.

Type material

We have selected herein the lectotype NHMUK 1887.2.9.2344, among the syntypes of the type series (**Fig. 11R**).

Type locality

Stn 186. Lat. 10°30'S, Long. 142°18'E, Wednesday Is., Cape York, 8 fms, coral mud.

Material examined

The type material and Campagne Lagon, 1992 - New Caledonia, Noumea Sector SW: Stn 1371, interior slope, 2 sh; Exp. Montrouzier Sept. '93, New Caledonia, Touho Sector East coast: Stn 1260, 49-59 m, 1 sh; Stn 1264, 8 m,

2 sh; Exp. Montrouzier Oct. '93, New Caledonia, Koumac Sector NW: Stn 1310, 15 m, 1 sh; Stn 1312, 26-40 m, 2 lv; Musorstom 10 1998, Fiji Islands: Stn DW 1314, 656-660 m, 1 sh; Atelier Lifou 2000, Loyalty Islands: Stn 1450, 27-31 m, 1 sh; Stn 1455, 15-20 m, 1 sh; Santo Marine Biodiversity Survey, 2006, Vanuatu Islands: Stn EP 22, 78-91 m, 1 lv; Stn EP 34, 40-80 m, 1 lv; Stn EP 36, 20-60 m, 1 lv; Stn FB 72, 16 m, 1 sh; Stn FB 90, 36-39 m, 1 lv; Stn ZB 09, 5-7 m, 1 sh; Stn ZM 15, intertidal, 1 sh.

Additional material

Few lots (all sh) from Australia (WAM), Yemen, Zanzibar Is. (MP), Philippine Islands, Papua - New Guinea (BR).

Additional description

Tube slightly arched and quite subcylindrical until the aperture, crossed by thin growth lines becoming 8-10 rings near the aperture and crossing the bulge placed on the latter. The tube contracts immediately after the bulge and has a small countersinking with a cutting edge. Septum dome-shaped, slightly hemispherical and raised over the cutting plane, often covered by calcareous encrustations. Aperture simple and circular. Operculum light brown and very thin with internal surface smooth and the external one showing about 10-12 very small concentric rings (**Fig. 19I**). Colour light brown in fresh specimens, semi-transparent white or translucent in the beached ones. Protoconch and soft parts unknown. Dimensions: mean length 1.7 mm; diam. 0.3 mm.

Distribution

The geographical distribution of this species, known up until now from northern Australia (Cape York) and eastern Arabia (Bosch et al. 1995), is herein extended to the Fiji Islands, New Caledonia, Loyalty Islands, Papua - New Guinea, Philippine Islands, Yemen, Zanzibar Is. and South Africa (unpub. data).

Remarks

Caecum succineum was illustrated some years after its description (Folin, 1886: pl. 3, fig. 16), but the drawings show a septum that is quite different from that of the type material: in fact, the illustrated septum is mucronate instead of slightly dome-shaped as in the lectotype (**Fig. 11R**).
A syntype of *C. subflavum* Folin 1879 is stored in NHMUK (**Fig. 12J**), consisting of two attached growth stages in which the presumed cutting plane can be detected. The shape of the last stage is quite similar to the adult stage of *C. succineum*, but also in this case the septum, later illustrated in the same publication (Folin, 1886: pl. 2, fig. 14), does not correspond to that shown by the syntype and anyhow different from that of *C. succineum*.
C. succineum is quite similar to *C.* cf. *glabellum* (Carpenter *in* Adams, 1868) (**Fig. 11N, P**), from which it differs by the consistent presence of 5-6 small rings near the aperture always edged by a bulge in the tube and by the lack of the very fine longitudinal worm-like microsculpture, always present in *C.* cf. *glabellum*.
The specimen from Stn 1371 has the same type of septum, but the point of the cutoff occurs before (**Fig. 12B**), showing the apertural portion of the previous growth stage still attached. In our opinion, such an anomaly does not invalidate the species identification as *C. succineum*.

Caecum japonicum (Habe, 1978)
(Figs 12D-F, 19D, 20K-P, 21E)

Pictocaecum japonicum Habe, 1978: pp. 1-3, pl. I, figs 14-17.

Type material

Pictocaecum japonicum Habe, 1978, holotype NSMT Mo 55371 (**Fig. 12E**) and 1 paratype NSMT Mo 55372.

Type locality

Matsugaura, Chiran-cho on the coast of Kagoshima Bay (Kyushu), Japan.

Material examined

The type material and Campagne Lagon, 1992 - New Caledonia, Nouméa SW Sector: Stn 1351, intertidal, 12 lv; Stn 1355, 7-10 m, 1 lv; Stn 1367, 10 m, 1 lv; Stn 1371, 12-16 m, 50 lv and 5 sh (larval); Bathus 1, 1993 - New Caledonia, East coast: Stn DW 1233, 45-50 m, 1 lv and 17 sh; Exp. Montrouzier Sept. '93, New Caledonia, Touho Sector East coast: Stn 1239, mangrove, 1 lv and 1 sh; Stn 1240, 0-2 m, 410 lv and 7 sh (1 larval); Stn 1242, intertidal, 162 lv and 6 sh; Stn 1245, intertidal, flats, sand, seagrass, 95 lv and 13 sh (juv); Stn 1246, intertidal, 5 lv; Stn 1250, 3-6 m, 1 lv and 5 sh; Stn 1253, 2-3 m, 70 lv; Stn 1255, 11 m, 23 lv and 3 sh; Stn 1256, 15-20 m, 1 lv; Stn 1259, 15-35 m, 6 lv and 6 sh; Stn 1260, 49-59 m, 16 lv and 4 sh; Stn 1261, 45-56 m, 1 sh; Stn 1264, 8 m, 75 lv and 9 sh; Stn 1266, 10-15 m, 58 lv and 2 sh; Stn 1269, 15-20 m, 5 lv and 3 sh; Stn 1270, 10-35 m, 9 lv and 2 sh; Stn 1271, 5-25 m, 52 lv (7 juv) and 2 sh (1 larval); Stn 1272, 10 m, 51 lv and 1 sh; Stn 1273, 20 m, 9 lv; Exp. Montrouzier Oct. '93, New Caledonia, Koumac Sector NW: Stn 1284, intertidal, 1 sh; Stn 1289, intertidal, 1 sh; Stn 1299, 12-14 m, 11 lv; Stn 1310, 15 m, 1 lv; Stn 1318, 20-30 m, 3 lv (in alcohol); Musorstom 8, 1994, Vanuatu Islands: Stn DW 1072, 622-625 m, 1 sh; Musorstom 10, 1998, Fiji Islands: Stn DW 1333, 200-215 m, 1 lv; Stn DW 1381, 275-430 m, 1 sh (juv.); Atelier Lifou 2000, Loyalty Islands: Stn 1453, 21-30 m, 1 lv; Santo Marine Biodiversity Survey, 2006, Vanuatu Islands: Stn DB 08, 12 m, 47 lv and 1 sh; Stn DB 12, 10-18 m, about 400 lv; Stn DB 14, 10-14 m, 36 lv and 1 sh; Stn DB 16, 32-40 m, 7 lv and 2 sh; Stn DB 20, 22-25 m, 7 lv and 13 sh; Stn DB 25, 10 m,

3 lv and 3 sh; Stn DB 29, 15 m, 240 lv and 16 sh; Stn DB 33, 14-25 m, 11 lv and 2 sh; Stn DB 40, 5 m, 32 lv; Stn DB 46, 2-3 m, 3 lv and 2 sh; Stn DB 53, 5 m, 161 lv and 8 sh; Stn DB 58, 6-43 m, 8 sh; Stn DB 63, 21 m, 9 lv and 2 sh; Stn DB 65, 13 m, 13 lv and 1 sh; Stn DB 67, 7 m, 10 lv; Stn DB 71, 7 m, 8 lv; Stn DB 75, 20 m, 3 sh; Stn DB 77, 42-45 m, 1 lv; Stn DB 80, 18 m, 92 lv; Stn DB 83, 6 m, 13 lv; Stn DB 86, 13 m, 44 lv; Stn DS 04, 25 m, 3 sh; Stn DS 10, 6-24 m, 1 sh; Stn DS 43, 22 m, 5 sh; Stn DS 49, 10-17 m, 5 lv; Stn DS 54, 5 m, 2 lv; Stn DS 91, 7 m, 2 sh; Stn DS 103, 70-80 m, 1 lv and 9 sh; Stn DS 105, 92 m, 1 sh; Stn ED 17, 23-27 m, 1 lv; Stn EP 01, 46-47 m, 2 lv and 2 sh; Stn EP 28, 90-110 m, 1 lv; Stn EP 34, 40-80 m, 22 lv; Stn EP 36, 20-60 m, 40 lv; Stn EP 37, 50-61 m, 1 lv; Stn EP 39, 75-80 m, 4 lv and 1 sh; Stn FB 40, 9 m, 20 lv and 1 sh; Stn FB 52, 7 m, 39 lv and 2 sh; Stn FB 56, 3-18 m, 12 lv; Stn FB 61, 2-3 m, 2 lv; Stn FB 64, m, 44 lv and 1 sh; Stn FB 68, 11 m, 32 lv and 1 sh; Stn FB 72, 16 m, 7 lv; Stn FB 80, 2 m, 160 lv; Stn FB 90, 36-39 m, 1 lv; Stn FB 92, 2-4 m, 23 lv; Stn FP 46-49, 45-50 m, 5 lv and 1 sh; Stn FS 54, 20-31 m, 2 lv; Stn LD 29, 10-12 m, 21 sh; Stn LS 17, 7 m, 2 lv and 1 sh; Stn NB 12, 20 m, 26 lv; Stn NB 43, 6-30 m, 1 lv; Stn NS 36, 2-3 m, 1 sh; Stn NS 37, 2-3 m, 11 sh; Stn ZB 09, 5-7 m, 134 lv; Stn ZB 16, ca. 5 m, 42 lv and 1 sh; Stn ZB 24, 26 m, 1 lv; Stn ZM 15, intertidal, 61 lv and 1 sh + 1 sh with anomalous septum.

Additional material

Many lots (lv and sh) from AMS: New Caledonia (Noumea), Fiji Islands, Papua - New Guinea, Vanuatu, Tonga (all AMS), Australia (WAM), Maldives Islands, Andaman Islands, Thailand, Australia (all MP), Fiji Islands, Papua - New Guinea, Japan (all BR).

Additional description

Tube smooth, slightly arched, subcylindrical up to the aperture, then clearly narrowing. Microsculpture consisting of minute growth lines only. Septum slightly dome-shaped and raised over the cutting plane. Round and simple aperture. The protoconch, planispiral of about 1.7 whorls, is smooth and vitreous, with a pronounced furrow separating it from the teleoconch. Operculum corneous, with a smooth internal surface, and the external with 5-6 concentric and slightly raised thin rings (**Fig. 19D**). Colour white, often interrupted by a zigzag brownish and yellowish pattern. Some specimens have a striped pattern along the axis, or an irregularly spotted pattern. Soft parts not studied. Dimensions: mean length 2.6 mm; max. diam. 0.6 mm, min. diam. 0.4 mm.

Distribution

Indo-WestPacific. From southern Japan (Habe, 1978), it is herein extended to New Caledonia, Fiji Islands, Loyalty Islands, Papua - New Guinea, Vanuatu Islands, Tonga, Australia and Thailand (West Pacific); Maldives Islands and Andaman Islands (Indian Ocean).

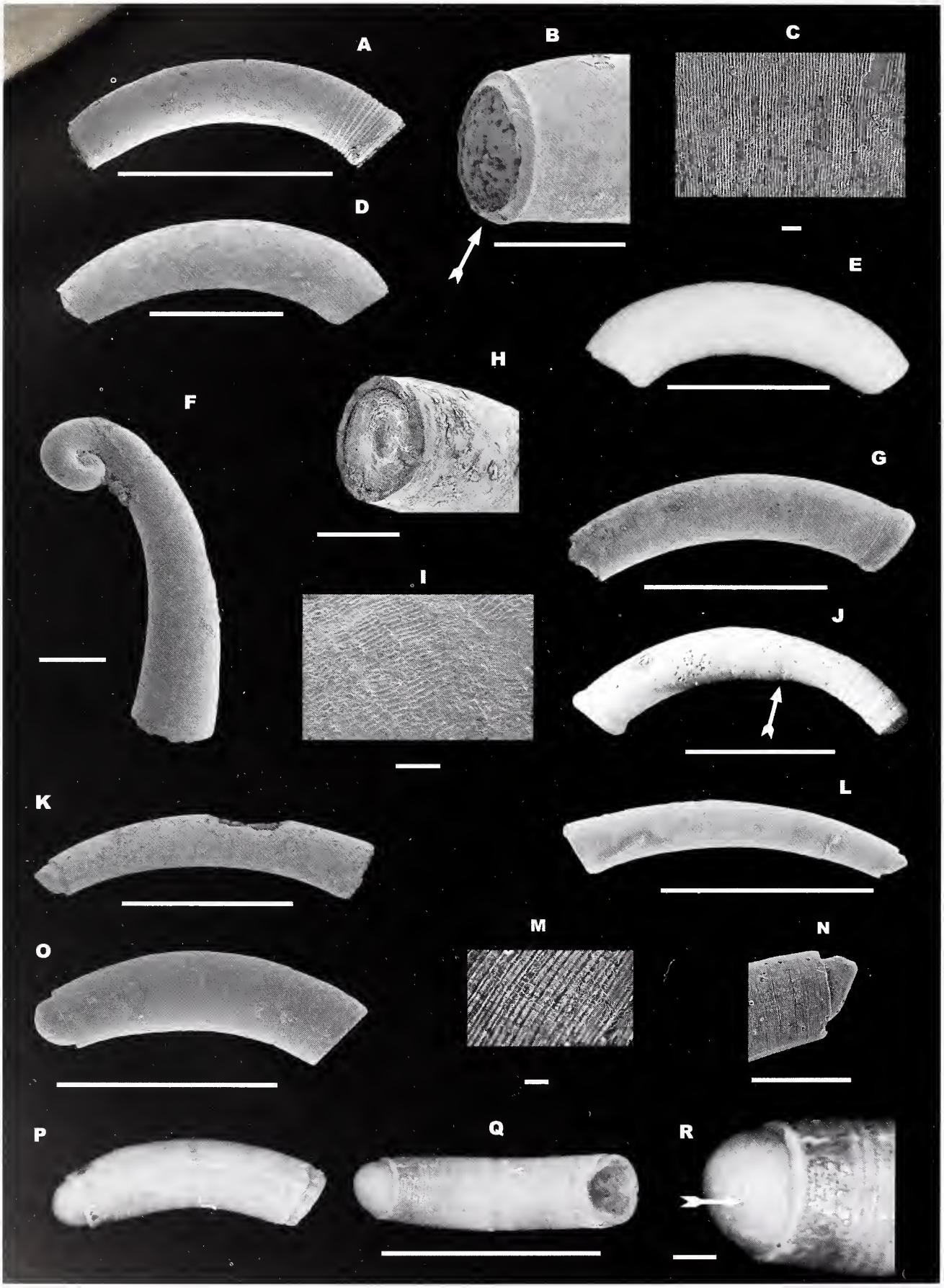
Remarks

Habe described this species and placed it in the new genus *Pictocaecum* characterized solely by the polychromatic pattern of the tube. This characteristic occurs in other species and particularly in those present in the Lusitanian Province like *C. atlantidis* Watson, 1897, *Caecum vitreum* Carpenter, 1859 (1859: p. 433) (Nofroni et al., 1997) and *Caecum wayae* Pizzini & Nofroni, 2001 from Azores Islands. In our opinion, these colour patterns cannot be considered as a single discriminating element at generic level, though it represents an important diagnostic characteristic to the interspecific level. *Caecum japonicum* resembles *Caecum heterochromum* Raines & Pizzini, 2005 from Easter Island, with its similar polychromatic colouration. However, *C. japonicum* is much larger and lacks the variable sculpture and microsculpture of *C. heterochromum* as well as the rimmed aperture.

Caecum musorstomi n. sp.
(Figs 12G-I, 19F)

Type material

Holotype (lv) MNHN 24921 and 8 paratypes (1 lv + 5 sh + 1 juv. + 1 sh broken) MNHN 24922 from type locality; Campagne Lagon, 1992 - New Caledonia, Nouméa Sector SW: 1 paratype (lv) MNHN 24923 Stn 1351; 1 paratype (lv) MNHN 24924 Stn 1355, 7-10 m; Bathus 1, 1993 - New Caledonia, East coast: 18 paratypes (1 lv and 17 sh) MNHN 24925 Stn DW 1233; Exp. Montrouzier Sept. '93, New Caledonia, Touho East coast Sector: 9 paratypes (sh) MNHN 24926 Stn 1260; 2 paratypes (sh) MNHN 24927 Stn 1261; 2 paratypes (sh) MNHN 24928 Stn 1264; 1 paratype (sh) MNHN 24929 Stn 1266; Exp. Montrouzier Oct. '93, New Caledonia, Koumac Sector NW: 1 paratype (sh) MNHN 24520 Stn 1277; 1 paratype (sh) MNHN 24521 Stn 1284; 2 paratypes [(1 lv MP) and (1 sh stored in MNHN)] MNHN 25159 Stn 1289; 2 paratypes (1 lv + 1 sh) MNHN 24522 Stn 1292; 4 paratypes (2 lv and 2 sh) MNHN 24523 Stn 1299; 2 paratypes (lv) MNHN 24524 Stn 1303; 1 paratype (sh) MNHN 24525 Stn 1331; Santo Marine Biodiversity Survey, 2006, Vanuatu Islands: 1 paratype (sh) MNHN 24526 Stn DB 08; 21 paratypes (8 lv and 13 sh) MNHN 24527 Stn DB 12; 3 paratypes (1 lv and 2 sh) MNHN 24528 Stn DB 14; 1 paratype (sh) MNHN 24529 Stn DB 20; 2 paratypes (sh) MNHN 24530 Stn DB 40; 16 paratypes (9 lv and 7 sh) MNHN 24531 Stn DB 53; 3 paratypes (3 sh) MNHN 24532 Stn DB 69; 3 paratypes (sh) MNHN 24533 Stn DS 43; 2 paratypes (sh) MNHN 24534 Stn DS 54; 1 paratype (sh) MNHN 24535 Stn FB 40; 7 paratypes (5 lv and 2 sh) MNHN 24536 Stn FB 52; 1 paratype (lv) MNHN 24537 Stn FB 61; 1 paratype (sh) MNHN 24538 Stn FB 92; 1 paratype (sh) MNHN 24539 Stn LD 09; 2 paratypes (sh) MNHN 24540 Stn LD 29; 2 paratypes (sh) MNHN 24541 Stn LS 17; 1 paratype (sh) MNHN 24542 Stn NS 36; 1 paratype (sh) MNHN 24543 Stn NS 37; 1 paratype (lv)



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MNHN 24544 Stn NB 12; 2 paratypes (sh) MNHN 24545 Stn ZB 16.

Type locality

Campagne Lagon 1992, New Caledonia, Nouméa Sector SW: Stn 1371, Larégnère reef, 22°19.9'S, 166° 17.6'/166° 16.1'E, inner slope, 12-16 m, P. Bouchet leg. 03/5/1992.

Material examined

Campagne Lagon 1992, New Caledonia, Nouméa SW Sector: Stn 1367, 10 m, *C.* cf. *musorstomi* 3 sh; Musorstom 10, Fiji Islands: Stn CP 1366, 149-168 m, *C.* cf. *musorstomi* 1 sh (broken); Santo Marine Biodiversity Survey, 2006, Vanuatu Islands: Stn LD 09, 2-3 m, *C.* cf. *musorstomi* 1 sh.

Additional material

Many lots (lv and sh) from Papua - New Guinea (all AMS) (LACM 80-26), Philippine Islands (MP and LACM 81-7), Japan (BR).

Description

Tube subcylindrical, somewhat arched and notably long, sculptured by large rough and obsolete rings, clearer near the aperture, weakly raised and with a round top. Rings and interspaces covered by a longitudinal worm-like microsculpture. In ventral view, septum protruded, with a squashed mucro, oriented toward the right side with respect to the axis of the shell; the profile of the ventral margin of the mucro varies from nearly flat in specimens of the second growth stage, to wavy and S-shaped in specimens of the third growth stage, and becoming convex at the adult stage, while the dorsal, seen in profile, is straight. Aperture circular, simple but rimmed by a well defined ring. Operculum light brown, externally sculptured by 6-7 concentric rings (**Fig. 19F**). Protoconch and soft parts unknown. From straw-coloured to white in beached specimen, reddish in fresh specimens provided with periostracum. Holotype dimensions: length 2.2 mm; diam. 0.4 mm.

Distribution

The geographical distribution of this species is from New Caledonia (Nouméa Sector), Philippine Islands (MP), Papua - New Guinea (AMS), southern Japan (Okinawa Is.) (BR) and Vanuatu Islands.

Etimology

The epithet refers to the Musorstom Expeditions made by MNHN.

Remarks

Caecum musorstomi n. sp. is similar to *C. succineum* (**Fig. 11R**) in the cylindrical shape of the tube and the rounded apertural ring, on the other hand it shows a different shape of the septum, mucronate in the new species, more or less dome-shaped in succineum, and for the presence of a worm-like microsculpture, completely lacking in the latter.

Caecum chinense Folin, 1868
(Fig. 12K-N)

Caecum chinense Folin, 1868b: p. 80, pl. 9, figs 3, 4.

Type material

C. chinense Folin, 1868, 4 syntypes (sh) MNHN, lectotype herein selected MNHN n. 24905 (**Fig. 12L**).

Type locality

Near Deux Freres, South China Sea.

Fig. 12. A. *Caecum succineum* Folin, 1880, anomalous specimen, Stn 1454 (scala = 1 mm). L = 1.6 mm. **B.** *C. succineum* Folin, 1880, the same specimen, Stn 1454, septum (scale bar = 200 μm). **C.** *C. succineum* Folin, 1880, the same specimen, Stn 1454, microsculpture (scale bar = 10 μm). **D.** *C. japonicum* (Habe, 1978), Stn 1240 (scale bar = 1 mm). L = 2.5 mm. **E.** *Pictocaecum japonicum* Habe, 1978, holotype NMNS (scale bar = 1 mm). L = 2 mm. **F.** *C. japonicum* (Habe, 1978), juv. (scale bar = 200 μm). **G.** *C. musorstomi* n. sp., holotype MNHN, Stn 1371 (scale bar = 1 mm). L = 1.9 mm. **H.** *C. musorstomi* n. sp., holotype MNHN, Stn 1371, septum (scale bar = 200 μm). **I.** *C. musorstomi* n. sp., holotype MNHN, Stn 1371, microsculpture (scale bar = 10 μm). **J.** *C. subflavum* Folin, 1880, syntype NHMUK 1887.2.9.2334 (scale bar = 1 mm). L = 2.2 mm. **K.** *C. chinense* Folin, 1868, Stn CP 1354 (scale bar = 1 mm). L = 2 mm. **L.** *C. chinense* Folin, 1868, lectotype MNHN n. 24905 (scale bar = 1 mm). L = 1.6 mm. **M.** *C. chinense* Folin, 1868, lectotype MNHN n. 24905, microsculpture (scale bar = 10 μm). **N.** *C. chinense* Folin, 1868, lectotype MNHN n. 24905, septum (scale bar = 200 μm). **O.** *C. inflatum* Folin, 1869, Vanuatu Islands: Stn LD 29 (scale bar = 1 mm). L = 1.5 mm. **P.** *C. inflatum* Folin, 1869, lectotype MNHN n. 24915 (scale bar = 1 mm), lateral view. L = 1.3 mm. **Q.** *C. inflatum* Folin, 1869, lectotype MNHN n. 24915 (scale bar = 1 mm), ventral view. **R.** *C. inflatum* Folin, 1869, lectotype MNHN n. 24915 (scale bar = 200 μm), septum, detail of growth lines (arrow).

Fig. 12 A. *Caecum succineum* Folin, 1880, esemplare anomalo, Stn 1454 (scale bar = 1 mm). L = 1,6 mm. **B.** *C. succineum* Folin, 1880, stesso esemplare, Stn 1454, setto (scala = 200 μm). **C.** *C. succineum* Folin, 1880, stesso esemplare, Stn 1454, microscultura (scala = 10 μm). **D.** *C. japonicum* (Habe, 1978), Stn 1240 (scala = 1 mm). L = 2,5 mm. **E.** *Pictocaecum japonicum* Habe, 1978, olotipo NMNS (scala = 1 mm). L = 2 mm. **F.** *C. japonicum* (Habe, 1978), juv. (scala = 200 μm). **G.** *C. musorstomi* n. sp., olotipo MNHN, Stn 1371 (scala = 1 mm). L = 1,9 mm. **H.** *C. musorstomi* n. sp., olotipo MNHN, Stn 1371, setto (scala = 200 μm). **I.** *C. musorstomi* n. sp., olotipo MNHN, Stn 1371, microscultura (scala = 10 μm). **J.** *C. subflavum* Folin, 1880, sintipo NHMUK 1887.2.9.2334 (scala = 1 mm). L = 2,2 mm. **K.** *C. chinense* Folin, 1868, Stn CP 1354 (scala = 1 mm). L = 2 mm. **L.** *C. chinense* Folin, 1868, lectotipo MNHN n. 24905 (scala = 1 mm). L = 1,6 mm. **M.** *C. chinense* Folin, 1868, lectotipo MNHN n. 24905, microscultura (scala = 10 μm). **N.** *C. chinense* Folin, 1868, lectotipo MNHN n. 24905, setto (scala = 200 μm). **O.** *C. inflatum* Folin, 1869, Isole Vanuatu: Stn LD 29 (scala = 1 mm). L = 1,5 mm. **P.** *C. inflatum* Folin, 1869, lectotipo MNHN n. 24915 (scala = 1 mm), vista laterale. L = 1,3 mm. **Q.** *C. inflatum* Folin, 1869, lectotipo MNHN n. 24915 (scala = 1 mm), vista ventrale. **R.** *C. inflatum* Folin, 1869, lectotipo MNHN n. 24915 (scala = 200 μm), setto, dettaglio delle strie di accrescimento (freccia).

Material examined

The type material and Musorstom 10, 1998, Fiji Islands: Stn CP 1354, 959-963 m, 1 sh (subadult); Santo Marine Biodiversity Survey, 2006, Vanuatu Islands: Stn DB 69, 38 m, 1 sh; Stn ET 14, 23-24 m, 1 lv; Stn LD 29, 10-12 m, 29 sh.

Additional material

Many lots (all sh) from Australia (WAM), Philippine Islands (MP), Papua - New Guinea, Japan (all BR).

Additional description

Tube slender, subcylindrical, smooth appearance, with more than 100 very small rings, visible only at very high magnification. Microsculpture absent, except for some very fine growth lines. In profile, septum sharp with dorsal and ventral margins almost straight; dorsal margin, after the first straight segment, turning abruptly to become concave, while the ventral becomes concave, then convex again and immediately after concave, forming a curved line with accentuated edges. Aperture simple and contracted. Operculum corneous, light brown; external surface crossed by 3-4 small, concentric, indistinct rings, from the edge towards the round nucleus, quite smooth and crossed by 2-3 fine rings; internal surface with 3-4 small, concentric, rough and ill-distinct rings. Protoconch and soft parts unknown. Dimensions: length, 2.2 mm; min. diam. 0.3 mm, max. diam. 0.4 mm.

Distribution

Described from the South China Sea (Folin, 1868) has been subsequently recorded from northern Australia (Folin, 1879b), Borneo (Kisch, 1959b) and Mozambique (Albano & Pizzini, 2011). It is here recorded from Vanuatu Islands, Australia (Queensland and W Australia), Philippine Islands, Papua - New Guinea, southern Japan (Okinawa Is.) and Fiji Islands. Furthermore, it also occurs in South Africa (unpublished data).

Remarks

C. chinense (**Fig. 12K-N**) resembles *C. attenuatum* Folin, 1880 (**Fig. 9O**) in its general subcylindrical shape. *C. chinense* appears to have a smooth tube, but it is actually crossed by very fine rings, much more than 100 in number, which are only visible at very high magnification (**Fig. 12M**). They are uniform and slightly raised with interspaces as large as the rings. *C. attenuatum* shows a sculpture comprised of small rings (in the lectotype about 63 crossing the entire tube, plus about 10 more small on the widening over the aperture can be detected) (**Fig. 9O**), more pronounced than that of *chinense*. Septum very similar in both species, with a curved anterior margin (**Fig. 12N**), S-shaped with a limited range of variability. In *chinense*, however, the cusp of the mucro is nearly always pointed and a slight hump can be noticed on the posterior margin depending on the growth stage of the shell, being more pointed in juveniles.

Caecum inflatum Folin, 1869
(Figs 12O-R)

Caecum inflatum Folin, 1869b: p. 121, pl. 15, figs 5, 6.

Type material

Kisch (1959b) listed 2 syntypes and 3 fragments in MNHN, among which a lectotype was selected (MNHN 24915) (**Fig. 13P-R**).

Type locality

Hong Kong.

Material examined

The type material and Exp. Montrouzier Oct. '93- New Caledonia, Koumac Sector NW: *C.* cf. *inflatum* Stn 1277, 0-2 m, 1 sh; *C.* cf. *inflatum* Stn 1292, intertidal, 1 sh (**Fig. 13A-C**); *C.* cf. *inflatum* Stn 1284, intertidal, 1 sh; Musorstom 10 1998, Fiji Islands: Stn DW 1381, 275-430 m, 2 sh (juv); Stn CP 1354, 959-963 m, 2 sh; Santo Marine Biodiversity Survey 2006, Vanuatu Islands: Stn LD 29, 10-12 m, 1 sh (**Fig. 12O**).

Additional material

Many lots (lv and sh) from Papua - New Guinea (AMS), Philippine Islands and Thailand (all MP), Papua - New Guinea (BR).

Additional description

Tube slightly subcylindrical notably in the adapical portion of the tube, arched, crossed by around 50 rings, sometimes obsolete, with a rounded top. No microsculpture on the rings or in the interspaces. Septum dome-shaped, very protruding, with an indistinct dorsal mucro, rotated towards the right side by about 45°. Slightly wavy scars visible in the anterior margin. Aperture simple, circular, unedged. Protoconch, operculum and soft parts unknown. Straw-coloured to whitish. Dimensions of the specimen from Stn LD 29: length 2.00 mm; min. diam. 0.25 mm, max. diam. 0.35 mm. Juveniles: tube subcylindrical, with a shiny surface, crossed by blurred and weakly raised rings, with the top slightly convex. Mucro changing its appearance, along the intermediate phases of its growth, with regard to its ventral margin, showing a wide range of variability, from nearly flat in specimens of the second growth stage, to sinuous and S-shaped of the third stage. Aperture circular.

Distribution

Hugues (1985a) extended the distribution of this species

from Hong Kong (Folin, 1869) to northern Australia (Cape York). This species is here recorded for the first time in New Caledonia (Koumac Sector), Vanuatu Islands, Fiji Islands, Papua - New Guinea, Philippine Islands and Thailand.

Remarks

The variability range of the adults is markedly wide, showing differences especially in the shape of mucro and sometimes in the shell sculpture, consisting of more or less marked rings. Juveniles of *C. inflatum* are different from the adults and could easily be confused with the adults of *C. attenuatum* Folin, 1880 (**Fig. 9O**), *C. chinense* Folin, 1868 (**Fig. 12L**) and *C. angustum*, Folin, 1886 (**Fig. 13D**).
In the first two species the tube has the same morphology, but the mucro of *attenuatum* is different, as its anterior margin, in profile, is curved and generally S-shaped, with a narrow variability range, while the margin of *inflatum* is variable. Furthermore, the mucro of *inflatum* shows some slightly wavy scars visible in ventral view and inclined at about 45° with respect to the axis of the tube (**Fig. 12R**). This character was first reported by Mooleenbeek et al. (1989), when dealing with *C. troglodyta* and by Linden & Moolenbeek (2000) for *C. vicinum* Folin, 1870. It was noticed in other species, such as *C. maestratii* n. sp. and *M. kajiyamai* Habe, 1963 and can be possibly regarded as growth lines of the septum. Moreover, *attenuatum* has a longitudinal microsculpture in the last third of the tube, near the aperture. *C. chinense* shows a different septum with a pointed triangular mucro. Compared with *C. angustum*, *C. inflatum* has the same general shape, but its annulated sculpture occurs all through the tube length, while in *angustum* it begins to show up only in its last fourth. *C. inflatum* can also be distinguished from *C. chinense* and *C. attenuatum* for the different shape of the tube, squat and subcylindrical in *C. inflatum*, slender and conical in the two other species.

Caecum bathus n. sp.
(Fig. 13E)

Type material

Holotype (sh) MNHN 24864 from type locality; Bathus 3, New Caledonia, Seamounts of the S of the Loyalty Ridge Norfolk Ridge, SW slope of New Caledonia; 1 paratype (sh) MNHN 24865 Stn DW 809, 650-730 m; 1 paratype (sh) MNHN 24866 Stn DW 827, 381-469 m; Smib 8, New Caledonia, Seamounts of the Norfolk Ridge: 1 paratype (sh) MNHN 24867 Stn DW 148, 510 m; Norfolk 1 Exp., Banc P, New Caledonia Ride de Norfolk, N/O "Alis": 1 paratype (sh) MNHN 24868 Stn DW 1723, 266-267 m; Bordau 1 Exp., N/O "Alis", Fiji Islands: 3 paratypes (sh) MNHN 24869 Stn DW 1469, 314-377 m.

Material examined

The type material and Tuamotu Archipelago, Ahe Atoll (French Polynesia), (14°28'S, 146°22'W), 1 m, 4 sh (LACM 73-94).

Type locality

New Caledonia, Stn DW 778, Ride des Loyauté, 24°43'S, 170°07'E, 750-760 m.

Description

Tube cylindrical, somewhat arched, slender, smooth, without any type of true sculpture, but only with very fine growth striation and a longitudinal worm-like microsculpture, only visible in the abapical portion of the tube. Septum perfectly dome-shaped, slightly emerging from the cutting plane, with some traces of a temporary septum. Aperture simple, circular, surrounded by a false ring determined by the widening of the tube. Protoconch, operculum and soft parts unknown. Holotype dimensions: length 1.6 mm; diam. 0.3 mm.

Distribution

At present known from type locality, Fiji Islands and Tuamotu Arch. (French Polynesia).

Etymology

The species takes its name from the oceanographic cruise Bathus and it is used here as a noun in apposition.

Remarks

Caecum bathus n. sp. strongly resembles *C. subcylindratum* n. sp. in the typology of the septum, but differs from it in the shape of the tube, clearly conical in the latter, in the shape of the aperture, more contracted and rounded in the latter, and by the presence of a longitudinal worm-like striation, lacking in *subcylindratum*. Additionally, *C. bathus* shows some resemblance with *C.* cf. *glabellum* (**Fig. 11N**) by having in common the same general shape, septum typology and the same kind of longitudinal worm-like microsculpture. However, in *glabellum* the microsculpture is much more pronounced and covers the whole tube (**Fig. 11P**), while in *C. bathus* it is clearly visible only in the abapical portion (**Fig. 13E**).

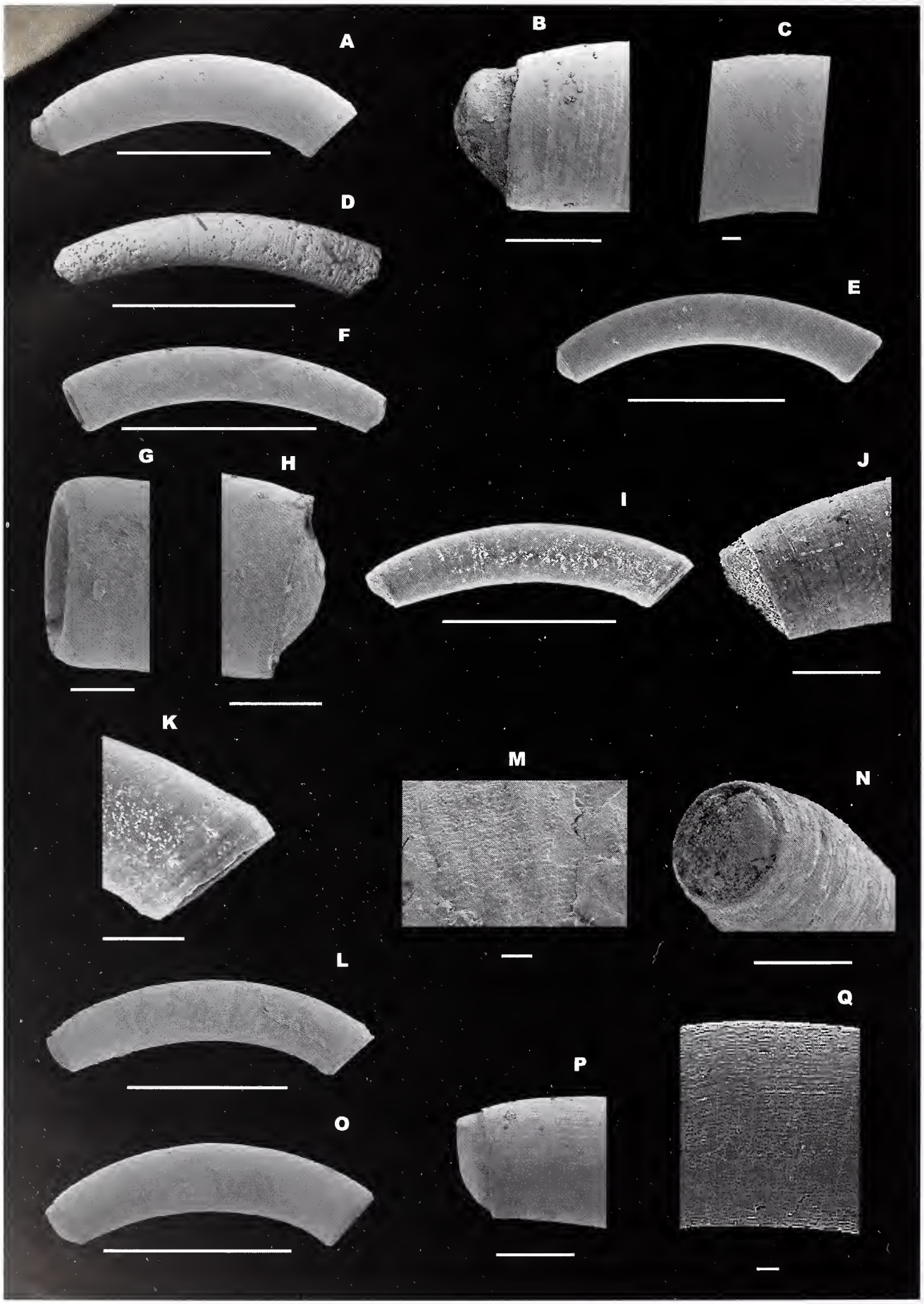
Caecum subcylindratum n. sp.
(Fig. 13F-H)

Type material

Holotype (sh) MNHN 24870 from type locality.

Type locality

Vanuatu Islands, N/O "Alis": Stn DW 1065, 16°16'S, 167°21'E, 360-419 m.



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Material examined

Only the type material.

Description

Tube smooth, somewhat arched, clearly subcylindrical, showing neither sculpture nor any type of microsculpture. Septum dome-shaped, slightly raised over the cutting plane. Aperture perfectly round, ending with a slight contraction. Colour semi-transparent, whitish, iridescent. Protoconch, operculum and soft parts unknown. Dimensions of the holotype: length 1.8 mm; min. diam. 0.2 mm, max. diam. 0.3 mm.

Distribution

This new species is currently known only from the type locality.

Etymology

The epithet takes its name from the subcylindrical shape of the tube (from the Latin *sub* = somewhat and *cylindratum* = cylindrical).

Remarks

This new species is unmistakable due to its general shape, and does not resemble any other species known from the Indo-Pacific area. However, it is somewhat similar in general shape and septum to *Caecum senegambianum* Folin, 1870 (syntype MNHN figured in Pizzini & Nofroni, 2001), a common species of the western African area.

Caecum mauritianum Folin, 1868 (Fig. 13I-K)

Caecum mauritianum Folin, 1868: vol. 1, p. 84, pl. 9, figs 8, 9.
Caecum glabella (Carpenter in Adams, 1868) *sensu* Lightfoot, 1992: p. 4, fig. 6.

Type material

C. mauritianum Folin, 1868, holotype (sh) (Fig. 13I-K) (MNHN).

Type locality

Mauritius Is.

Material examined

The type material and Exp. Montrouzier Oct. '93 - New Caledonia, Koumac Sector NW: Stn 1277, 0-2 m, 2 sh; Stn 1284, intertidal, 1 sh; Bathus 1, 1993 - New Caledonia, East coast; Stn DW 654, 237-298 m, *C.* cf. *mauritianum*, 1 sh.

Additional material

Few lots (lv and sh) from the Philippine Islands and Thailand (all MP).

Additional description

Tube slightly subcylindrical, slightly arched, seemingly smooth, but with a microsculpture consisting of fine growth lines alternating with more conspicuous and gross ones less closely set but regularly spaced than growth lines; irregular longitudinal striations are also visible at high magnification. Septum mucronate and generally lined up with the axis of the tube, with ventral margin slightly convex and the dorsal with a small appendage bending toward the dorsal side. Aperture hemmed by a slight belt-shaped swelling crossed by 2-3 fine rings. Operculum corneous, with outer surface crossed by 5-6 concentric rings, growing from the periphery to the center, smooth; inner surface smooth showing a raised nucleus with numerous helicoidally radiating rays. Protoconch and soft parts unknown. Colour white. Dimensions of the specimen from Stn 1292: length 1.73 mm; min. diam. 0.25 mm, max. diam. 0.35 mm.

Fig. 13. A. *Caecum* cf. *inflatum* Folin, 1869, Stn 1284, (scale bar = 1 mm). L = 2.1 mm. **B.** *C.* cf. *inflatum* Folin, 1869, Stn 1284, septum (scale bar = 200 μm). **C.** *C.* cf. *inflatum* Folin, 1869, Stn 1284, microsculpture (scale bar = 50 μm). **D.** *C. angustum* Folin, 1886, holotype NHMUK 1887.2.9.2364 (scale bar = 1 mm). **E.** *C. bathus* n. sp., holotype MNHN, Bathus 3, New Caledonia, Stn DW 778, Ride des Loyauté, (scale bar = 1 mm). L = 2.1 mm. **F.** *C. subcylindratum* n. sp., holotype MNHN, Stn DW 1065 (scale bar = 1 mm). L = 1.7 mm. **G.** *C. subcylindratum* n. sp., holotype MNHN, Stn DW 1065, aperture (scale bar = 100 μm). **H.** *C. subcylindratum* n. sp., holotype MNHN, Stn DW 1065, septum (scale bar = 100 μm). **I.** *C. mauritianum* Folin, 1868, holotype MNHN (scale bar = 1 mm). L = 1.9 mm. **J.** *C. mauritianum* Folin, 1868, holotype MNHN, septum (scale bar = 200 μm). **K.** *C. mauritianum* Folin, 1868, holotype MNHN, aperture (scale bar = 200 μm). **L.** *C. microstriatum* n. sp., paratype Stn 1292 (scale bar = 1 mm). L = 2 mm. **M.** *C. microstriatum* n. sp., paratype Stn 1292, microsculpture (scale bar = 10 μm). **N.** *C. microstriatum* n. sp., paratype Stn 1292, septum (scale bar = 200 μm). **O.** *C. microstriatum* n. sp., holotype MNHN, Stn 1277 (scale bar = 1 mm). L = 1.75 mm. **P.** *C. microstriatum* n. sp., holotype MNHN, Stn 1277, septum (scale bar = 200 μm). **Q.** *C. microstriatum* n. sp., holotype MNHN, Stn 1277, microsculpture (scale bar = 50 μm).

Fig. 13. A. *Caecum* cf. *inflatum* Folin, 1869, Stn 1284, (scala = 1 mm). L = 2,1 mm. **B.** *C.* cf. *inflatum* Folin, 1869, Stn 1284, setto (scala = 200 μm). **C.** *C.* cf. *inflatum* Folin, 1869, Stn 1284, microscultura (scala = 50 μm). **D.** *C. angustum* Folin, 1886, olotipo NHMUK 1887.2.9.2364 (scala = 1 mm). **E.** *C. bathus* n. sp., olotipo MNHN, Bathus 3, Nuova Caledonia, Stn DW 778, Dorsale delle Isole della Lealtà, (scala = 1 mm). L = 2,1 mm. **F.** *C. subcylindratum* n. sp., olotipo MNHN, Stn DW 1065 (scala = 1 mm). L = 1,7 mm. **G.** *C. subcylindratum* n. sp., olotipo MNHN, Stn DW 1065, apertura (scala = 100 μm). **H.** *C. subcylindratum* n. sp., olotipo MNHN, Stn DW 1065, setto (scala = 100 μm). **I.** *C. mauritianum* Folin, 1868, olotipo MNHN (scala = 1 mm). L = 1,9 mm. **J.** *C. mauritianum* Folin, 1868, olotipo MNHN, setto (scala = 200 μm). **K.** *C. mauritianum* Folin, 1868, olotipo MNHN, apertura (scala = 200 μm). **L.** *C. microstriatum* n. sp., paratipo Stn 1292 (scala = 1 mm). L = 2 mm. **M.** *C. microstriatum* n. sp., paratipo Stn 1292, microscultura (scala = 10 μm). **N.** *C. microstriatum* n. sp., paratipo Stn 1292, setto (scala = 200 μm). **O.** *C. microstriatum* n. sp., olotipo MNHN, Stn 1277 (scala = 1 mm). L = 1,75 mm. **P.** *C. microstriatum* n. sp., olotipo MNHN, Stn 1277, setto (scala = 200 μm). **Q.** *C. microstriatum* n. sp., olotipo MNHN, Stn 1277, microscultura (scala = 50 μm).

Distribution

Previously only known from the type locality (Mauritius Is.), its geographic distribution is herein extended to New Caledonia (Koumac Sector and E coast), Thailand, Philippine Islands and Hawaiian Islands (Lightfoot, 1992b as *C. glabellum*).

Remarks

Lightfoot (1992) misidentified this species as *C. glabellum* (Carpenter in Adams, 1868), based on Adams' brief description. The septum of *glabellum* is very low dome shaped and only somewhat protruded over the cutting plane, while *mauritianum* has a septum which is mucronate and well exerted. *C. mauritianum* (**Fig. 13I-K**) strongly resembles *C. microstriatum* n. sp. (**Fig. 13O**), which shows longitudinal striations with a different pattern, compared with all the other species. Also the prominence in the edge of the aperture is different, being more rounded in *microstriatum*, which also differs by having a blunter mucro.

Caecum microstriatum n. sp.
(Fig. 13L-Q)

Type material

Holotype (sh) MNHN 24871 and 1 paratype (sh) (coated) (meas. length 2.4 mm; diam. 0.5 mm) MNHN 24872 from type locality; 1 paratype (sh) (coated) (meas. length 1.9 mm; diam. 0.4 mm) MNHN 24873 from Exp. Montrouzier Sept. '93 - New Caledonia, Touho Sector East coast: Stn 1264, 8 m; 1 paratype (sh) (coated) MNHN 24546 (Fig. 13L-N) Stn 1292, intertidal, 1 lv and 1 sh.

Type locality

Exp. Montrouzier Oct. '93 - New Caledonia, Koumac Sector NW: Stn 1277, Koumac Cove (Ouanap Bay), 20°34'S, 164°16 E, soft bottom, seagrass, 0-2 m.

Material examined

The type material and *C. mauritianum* Folin, 1868, holotype (sh) (**Fig. 13I-K**) (MNHN); *C. succineum* Folin, 1880 (lectotype NHMUK 1887.2.9.2344, **Fig. 11R**).

Description

Tube somewhat arched, cylindrical, crossed by a microsculpture made up by a fine and irregular longitudinal striation covering the entire length of the tube, and by small growth lines. A slight swelling is visible near the aperture. Septum mucronate, in profile with a S-shaped silhouette, with a mucro turned to the right side by about 30°. Protoconch, operculum and soft parts unknown. Colour transparent white. Dimensions of the holotype: length 1.9 mm; diam. 0.3 mm.

Distribution

Currently known only from New Caledonia (Touho and Koumac Sectors).

Etymology

The name refers to the characteristic longitudinal striation of the tube.

Remarks

C. microstriatum n. sp. (**Fig. 13O**), except for some morphological affinities with *C. mauritianum* Folin, 1868, can otherwise be distinguished mainly by its microsculpture (**Fig. 13M**), which is very distinct and consisting of irregular longitudinal striae covering the whole length of the tube. Moreover *C. mauritianum* (**Fig. 13I**) has a more protruding septum with a different shape (**Fig. 13J**) and the tube is slenderer and less arched. *C. microstriatum* also resembles *C. succineum* Folin, 1880 (lectotype NHMUK 1887.2.9.2344, **Fig. 11R**). However, the latter does not show any longitudinal microsculpture and has a slightly hemispherical septum.

Caecum modestum Folin, 1868
(Figs 14C-F, 19E, 21C-E)

Caecum modestum Folin, 1868: p. 57, fig. 2.
Caecum malleatum var. *sublaevis* Folin, 1868: p. 58, fig. 3.

Type locality

Noumea (New Caledonia).

Material examined

C. modestum: 13 syntypes (3 juv) and 4 fragments MNHN (fide Kisch 1959b); among them we have selected the lectotype MNHN n. 24913 (**Fig. 14F**); Santo Marine Biodiversity Survey, 2006, Vanuatu Islands: 1 sh, Stn DB 08; 2 lv and 4 sh, Stn DB 40; 3 lv and 1 sh, Stn DB 46; 61 lv and 11 sh, Stn DB 53; 1 lv and 1 sh, Stn DS 54; 1 sh, Stn ED 02; 4 lv, Stn FB 40; 1 sh, Stn FB 61; 2 lv and 2 sh, Stn FB 80; 10 lv and 38 sh, Stn LD 09; 6 sh, Stn LD 29; 1 sh, Stn LD 30; 1 sh, Stn LS 2; 1 lv and 1 sh, Stn NS 37; 32 lv, Stn ZM 15; Exp. Montrouzier Oct. '93 - New Caledonia, Koumac Sector NW: 8 sh, 19 lv and 14 juv., Stn 1291; Campagne Lagon - New Caledonia - Noumea Sector: 10 lv and 4 sh, Stn 1351; Exp. Montrouzier Oct. '93 - New Caledonia - Koumac Sector NW: 248 lv and 65 sh, Stn 1277; 109 sh, Stn 1278; 1 lv (in alcohol), Stn 1278; 228 sh, Stn 1279; 1 sh, Stn 1280; 2 sh, Stn 1282; 22 lv and 20 sh, Stn 1284;13 juv., 26 sh and 20 lv, Stn 1289; 46 sh and 51 lv, Stn 1292; 4 sh, Stn 1298; 1 lv (juv.), Stn 1299; 3 lv and 48 sh (in alcohol), Stn 1300; 9 sh, 9 lv and 2 lv (in alcohol), Stn 1303; 1 lv, Stn 1307; 1 lv, Stn 1319; 1 sh (2 growth stages still attached), Stn 1331; Exp. Montrouzier Sept. '93 - New Caledonia, Touho Sector East coast: 7 lv and 1 sh, Stn 1239; 22 lv and 17 sh, Stn 1240; 1 sh, Stn 1241; 68

lv and 23 sh, Stn 1242; Stn 1245, 1 sh; Stn 1250, 1 sh; 1 lv and 3 sh, Stn 1253; 1 lv (subadult), Stn 1259; 1 sh, Stn 1260; 1 sh, Stn 1261; 3 sh, Stn 1264; 1 lv, Stn 1267; many lots (lv and sh) from New Caledonia (Noumea), Vanuatu Islands, Papua - New Guinea, Solomon Islands (all AMS), Australia (WAM), Philippine Islands, (MP), Papua - New Guinea (BR).

Additional description

Tube smooth, subcylindrical, becoming larger near the aperture and contracting immediately after, in a simple-edged aperture. Microsculpture of very fine growth striae, although at stronger magnification appearing formed by transversally aligned micrograins. Septum with a mucro oriented towards the dorsal side and slightly towards the right by about 15°; ventral side straight to slightly convex, and the dorsal straight to concave, depending on the growth stage of the shell. Juvenile specimens having a much more protruding mucro. Operculum circular, corneous, thin and brown; external surface showing a sculpture of several concentric and very evanescent rings, inner surface seemingly smooth (90x) with a raised central nucleus (**Fig. 19E**). Colour whitish in beached specimens, light beige in specimens with periostracum. Protoconch and soft parts unknown. Dimensions: mean length 1.7 mm; mean width 0.4 mm.

Distribution

This species has never been cited by previous authors who studied the Indo-Pacific malacofauna. Folin (1868) limited its geographical distribution to New Caledonia (Noumea). This species is recorded from Western Australia, Vanuatu Islands, Solomon Islands, Papua - New Guinea and Philippine Islands.

Remarks

Some years ago, the first author examined the type series of *C. malleatum* Folin, 1868 stored in MNHN. The original label reads "*C. malleatum* var. *sublaevis*" (**Fig. 14G**, original drawing), referring to a taxon which has never been described and thus has to be considered *nomen nudum*. These specimens are identical to *C. modestum* (**Fig. 14F**), except for the growth striae (much more pronounced) giving a frosted look to the tube, which falls in the range of variability of *modestum*. Indeed, in our opinion *C. malleatum* is a junior synonym of *C. modestum*. The latter, described in the same publication, has priority (p. 57, while the other is p. 58). *C. modestum* seems to have a high variability level, both in dimensions and the shape of the septum. However the general shape of the tube and the unique type of microsculpture, do not leave any doubt about the identity of this species.

Caecum cooki Pizzini & Raines, 2011
(Figs 14H-J, 19J)

Caecum cooki Pizzini & Raines, 2011: pp. 29-31, fig. 4A, B.

Type material

Holotype (sh) and 1 paratype (sh juv.) from type locality; 1 paratype (sh) from Tahiti (Society Islands), Tiarei, fringing reef, shell grit.

Type locality

Makemo Is., Arikitamiro Passage (Tuamotu Archipelago), lagoon along side of the airport, shell grit.

Material examined

The type material and Tetiaroa (Windward Islands of the Society Islands), shell grit, 1 sh juv.; Makemo (Tuamotu Archipelago), Arikitamiro Passage, lagoon along side of the airport, shell grit, 23 sh; Exp. Montrouzier Sept. '93-New Caledonia, Touho Sector East coast: Stn 1260, 49-59 m, 1 sh; Musorstom 10 1998, Fiji Islands: Stn DW 1381, 275-430 m, 5 sh; Atelier Lifou 2000, Loyalty Islands: Stn 1429, 8-18 m, 1 sh; Stn 1434, 5-20 m, 1 sh; Stn 1442, 47 m, 1 sh; Stn 1450, 27-31 m, 1 sh; Stn 1451, 10-21 m, 1 sh; Stn 1454, 15-18 m, 2 lv and 3 sh; Stn 1456, 25-30 m, 1 sh; Stn 1457, 5-10 m, 1 sh; Santo Marine Biodiversity Survey 2006, Vanuatu Islands: Stn DB 20, 22-25 m, 1 lv.

Additional material

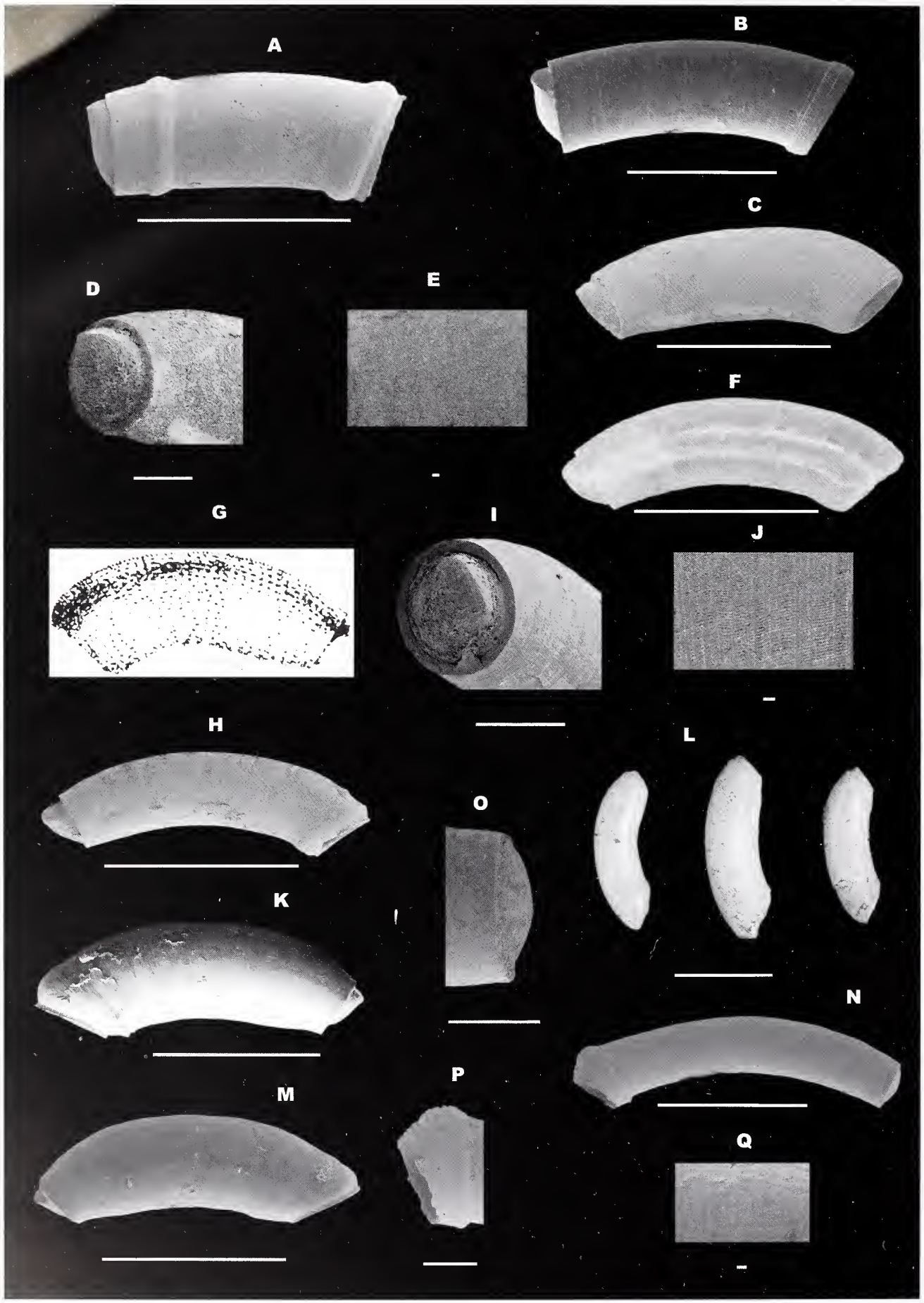
Few lots (all sh) from Society Islands (AMS) (LACM 74-36), Indonesia (LACM 88-63 and 88-55), and Kenya (MP), French Polynesia (J. Letourneux, pers. comm.).

Additional description

Tube slightly arched, subcylindrical in the first quarter, becoming cylindrical towards aperture, near which, almost at one fifth of the total length, the tube bends remarkably toward the ventral side, subsequently it widens forming a swelling, more conspicuous from the ventral side, which abruptly tightens and eventually expands to form a small sharp edge. Surface seemingly smooth, with minute longitudinal striations visible only at high magnification. Numerous growth lines are present, more pronounced in the terminal section of the tube. In frontal view, with the posterior edge turned upwards, the apex of the septum, mucronate, points to the right at about 30°. In lateral view, its anterior margin is slightly S-shaped, while the posterior shows a small concavity after the cutting plane. Operculum very characteristic, thick, corneous, light brown; its internal surface shows a quite smooth surface with a subcylindrical cusp raised at its center; its external surface crossed by 6-7 slightly raised concentric rings, with a depressed center (**Fig. 19J**). Colour from translucent to chalky white in the beached specimens. Protoconch and soft parts unknown. Dimensions: length 1.8 mm; width 0.4 mm.

Distribution

Originally described from Tuamotu Archipelago and Society Islands, its geographical distribution is herein ex-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tended to the Loyalty Islands, New Caledonia, Fiji Islands, Vanuatu Islands, Samoan Islands (Enrico Schwabe, ZSM, pers. comm.), Indonesia (LACM) and Kenya.

Remarks

C. cooki is similar to *C. bimarginatum* Carpenter, 1858 (**Fig. 14K**) in the shape of the tube. However, *C. cooki* differs by the presence of a longitudinal microsculpture (completely lacking in *bimarginatum*), and in the shape of the septum which is more protruding and with a pointed mucro. Regarding the similarities between *C. cooki* and *C. bimarginatum* on the one hand and of *C. ryssotitum* Folin, 1867 and *C. laeve* C.B. Adams, 1852 on the other, we simply report here the conclusions to which Pizzini & Raines (2011) came. The last two taxa are distinguished from *C. cooki*, while *C. bimarginatum* is nearly indistinguishable from *C. ryssotitum* (**Fig. 14L**). *C. ryssotitum*, an endemic species from the southern Caribbean, remains in our opinion a taxon of a doubtful status due to its geographical range. In fact, in the last 15 years we have never found a single specimen of this species amidst several thousands of Caecidae examined from the entire Indo-Pacific Ocean, nor have we found any mention of it in the literature regarding this region. We suspect that *C. bimarginatum* does not exist in the Indo-Pacific Ocean, but it is simply a mislabeling of the species.
C. cooki is similar to the Panamic *C. laeve* (**Fig. 14M**) (holotype figured in Turner, 1956: p. 127, pl. 17, fig. 5) in the general shell shape, which is however more slender in the former. Furthermore, *C. cooki* differs from *C. laeve* by the presence of a longitudinal microsculpture which is absent in *C. laeve*, and in the shape of the septum, being more protruding with a pointed mucro and a less angled aperture.

Caecum uvea n. sp.
(Fig. 14N-Q)

Type material

Holotype (sh) MNHN 24835 from type locality.

Type locality

Musorstom 7, 1992, Wallis Islands, SW Pacific: Stn DW 605, 13° 21'S, 176° 08'W, 335-340 m.

Description

Tube slightly arched and subcylindrical, with nearly parallel dorsal and ventral sides. Tube, totally devoid of any sculpture, crossed only by fine growth lines becoming more evident on the swelling. A microsculpture formed by microgranules near the posterior end is visible only at high magnification. Septum dome-shaped, slightly raised over the cutting plane. The aperture, strongly oblique, shows a noticeable ring at the edge, thicker on the dorsal side and crossed in its turn by 5 small rings. Protoconch, operculum and soft parts unknown. Colour white. Holotype dimensions: length 2.3 mm; min. diam. 0.4 mm, max. diam. 0.5 mm.

Distribution

Currently known only from type locality (Wallis Islands).

Etymology

This epithet refers to the original Polynesian name of Wallis Island and it is used here as a noun in apposition.

Remarks

This new species presents some similarities with *C. succineum* Folin, 1880 (**Fig. 11Q**), in the shape of the tube and the septum slightly raised over the cutting plane, differing for a different shape of the aperture, surrounded by a large ring crossed by 5 small rings.

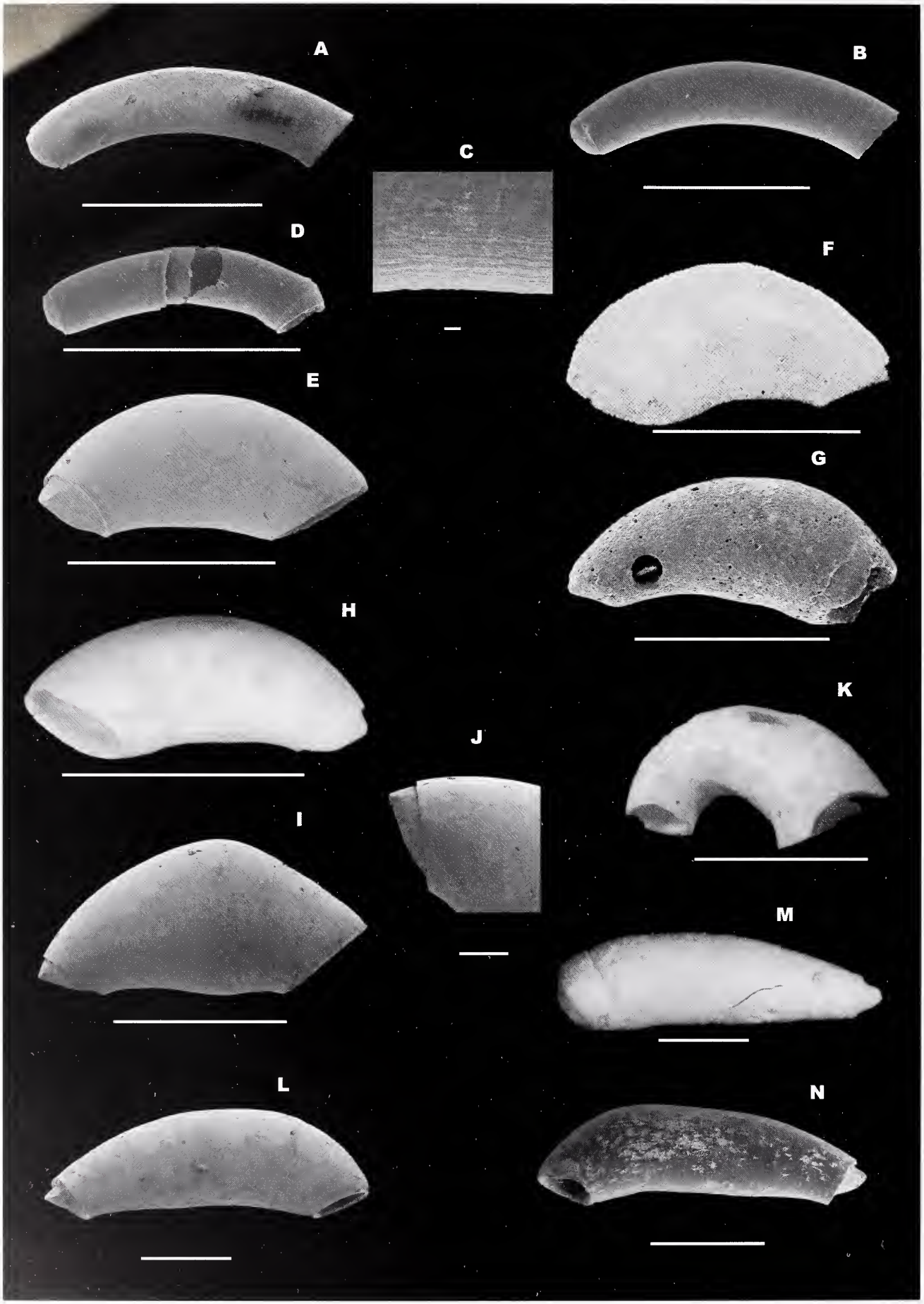
Caecum vanuatuarum n. sp.
(Fig. 15A-C)

Type material

Holotype MNHN 24876 from type locality (Fig. 15A)

Fig. 14. A. *Caecum sp.* B, Stn DW 1381 (scale bar = 500 μm). L = 0.75 mm. **B.** *C. danielei* Pizzini & Raines, 2011, holotype MNHN n. 22066, Makemo (Tuamotu Arch.), Passe Arikitamiro, (scale bar = 1 mm). L = 2.2 mm. **C.** *C. modestum* Folin, 1868, Stn 1291 (scale bar = 1 mm). L = 1.9 mm. **D.** *C. modestum* Folin, 1868, Stn 1291, septum (scale bar = 200 μm). **E.** *C. modestum* Folin, 1868, Stn 1291, microsculpture (scale bar = 20 μm). **F.** *C. modestum* Folin, 1868, lectotype MNHN n. 24913 (scale bar = 1 mm). L = 1.9 mm. **G.** *C. malleatum* Folin, 1868, orig. fig. **H.** *C. cooki* Pizzini & Raines, 2011, Stn 1454 (scale bar =1 mm). L = 1.8 mm. **I.** *C. cooki* Pizzini & Raines, 2011, Stn 1454, septum (scale bar = 200 μm). **J.** *C. cooki* Pizzini & Raines, 2011, Stn 1454, microsculpture (scale bar = 10 μm). **K.** *C. bimarginatum* Carpenter, 1858 (1858:431), lectotype NHMUK (scale bar = 1 mm). L = 2 mm. **L.** *C. ryssotitum* Folin 1867, syntypes NHMUK 1868.2.17.7 (scale bar = 1 mm). L = 1.9 mm. **M.** *C. laeve* C. B. Adams 1852, Kobbe Beach, Canal Zone, Panama, (scale bar = 1 mm). L = 1.8 mm. **N.** *C. uvea* n. sp., holotype MNHN, Stn DW 605 (scale bar = 1 mm). L = 2.2 mm. **O.** *C. uvea* n. sp., holotype MNHN, Stn DW 605, septum (scale bar = 200 μm). **P.** *C. uvea* n. sp., holotype MNHN, Stn DW 605, aperture (scale bar = 200 μm). **Q.** *C. uvea* n. sp., holotype MNHN, Stn DW 605, microsculpture (scale bar = 20 μm).

Fig. 14. A. *Caecum sp.* B, Stn DW 1381 (scala = 500 μm). L = 0,75 mm. **B.** *C. danielei* Pizzini & Raines, 2011, olotipo MNHN n. 22066, Makemo (Arcipelago Tuamotu), Passaggio Arikitamiro, (scala = 1 mm). L = 2,2 mm. **C.** *C. modestum* Folin, 1868, Stn 1291 (scala = 1 mm). L = 1,9 mm. **Fig. 14. D.** *C. modestum* Folin, 1868, Stn 1291, setto (scala = 200 μm). **E.** *C. modestum* Folin, 1868, Stn 1291, microscultura (scala = 20 μm). **F.** *C. modestum* Folin, 1868, lectotipo MNHN n. 24913 (scala = 1 mm). L = 1,9 mm. **G.** *C. malleatum* Folin, 1868, fig. orig. **H.** *C. cooki* Pizzini & Raines, 2011, Stn 1454 (scala =1 mm). L = 1,8 mm. **I.** *C. cooki* Pizzini & Raines, 2011, Stn 1454, setto (scala = 200 μm). **J.** *C. cooki* Pizzini & Raines, 2011, Stn 1454, microscultura (scala = 10 μm). **K.** *C. bimarginatum* Carpenter, 1858 (1858:431), lectotipo NHMUK (scala = 1 mm). L = 2 mm. **L.** *C. ryssotitum* Folin 1867, sintipi NHMUK 1868.2.17.7 (scala = 1 mm). L = 1,9 mm. **M.** *C. laeve* C. B. Adams 1852, Kobbe Beach, Zona del Canale, Panama, (scala = 1 mm). L = 1,8 mm. **N.** *C. uvea* n. sp., olotipo MNHN, Stn DW 605 (scala = 1 mm). L = 2,2 mm. **O.** *C. uvea* n. sp., olotipo MNHN, Stn DW 605, setto (scala = 200 μm). **P.** *C. uvea* n. sp., olotipo MNHN, Stn DW 605, apertura (scala = 200 μm). **Q.** *C. uvea* n. sp., olotipo MNHN, Stn DW 605, microscultura (scala = 20 μm).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and 2 paratypes (sh) MNHN 24877 Vanuatu Islands: Stn EP 34, 40-80 m (Fig. 15B); 1 paratype (sh) MNHN 24878 Stn DB 75, 20 m; 1 paratype (sh) MNHN 24879 Stn NS 36, 2-3 m.

Type locality

Santo Marine Biodiversity Survey, 2006, Vanuatu Islands: Stn DB 69, 15°24.4'S, 167°13.0'E, Palikulo Bay, sand and coral patches, 38 m.

Description

Tube somewhat arched, slightly subcylindrical, crossed by few growth striae irregularly marked and spaced out. Microsculpture comprised of a marked and rough worm-like longitudinal striation, covering the whole length of the tube. Septum mucronate, somewhat protruding over the cutting plane with a rounded appendage turned to the right side of about 30°. Aperture simple, without varix. Colour whitish in beached specimens. Holotype dimensions: length 1.8 mm; min. diam. 0.3 mm; max. diam. 0.4 mm. Paratype Stn EP 34 dimensions: lenght 2 mm; diam. in the middle of the tube 0.4 mm.

Distribution

Only known from the type locality.

Etymology

The specific name comes from the area of the type locality.

Remarks

The new species is very similar to *C. microstriatum* n. sp. (**Fig. 13L-Q**) having in common the same tube shape, longitudinal microsculpture and dimensions. The main difference between the two species consists in the shape of the septum, mucronate turned to the right side, in profile with a clear S-shaped silhouette in *microstriatum* (**Fig. 13P**), mucronate but with a convex profile in *Caecum vanuatuarum* n. sp. (**Fig. 15A**). Furthermore, there are some differences regarding the type of longitudinal microsculpture, comprised of fine and irregular striae in *microstriatum*, rougher and irregular in *vanuatuarum*. Furthermore, in *C. vanuatuarum* the aperture is simple.

Caecum sp. *A*
(Fig. 15D)

Material examined

Musorstom 10 1998, Fiji Islands: Stn CP 1369, S of Viti Levu, 18°11.1'S, 178°23.4'E, 392-433 m, 1 sh.

Remarks

This specimen was broken during sample preparation for SEM observation (**Fig. 15D**). It shows some resemblances with *C. vanuatuarum* n. sp. (**Fig. 15A**) with regard to the shape of the tube and the septum, while the main difference seems to be the complete lack of microsculpture on the tube of the *C. sp.* A. The shape of the aperture suggests that this specimen could be juvenile.

Caecum sp. *B*
(Fig. 14A)

Material examined

Musorstom 10 1998, Fiji Islands: Stn DW 1381, S of Viti Levu, 275-430 m, 1 sh; Stn CP 1369, S of Viti Levu, 392-433 m, 1 sh juv.

Remarks

The specimen from Stn DW 1381 (**Fig. 14A**) presents the first varix at about 1/5 of its total length, in the adapical portion of the tube; a second varix edges the aperture. Despite some resemblances with *C. daniele*i Pizzini & Raines, 2011 (**Fig. 14B**), i.e. similar type of septum and general shell shape, as well as the occurrence of axial

Fig. 15. A. *Caecum vanuatuarum* n. sp., holotype MNHN, Stn DB 69, Palikulo Bay (scale bar = 1 mm). L = 1.8 mm. **B.** *C. vanuatuarum* n. sp., paratype MNHN, Santo Marine Biodiversity Survey, 2006, Vanuatu Islands: Stn EP 34, (scale bar = 1 mm). L = 2 mm. **C.** *C. vanuatuarum* n. sp., paratype MNHN, Santo Marine Biodiversity Survey, 2006, Vanuatu Islands: Stn EP 34, microsculpture (scale bar = 20 μm). **D.** *C. sp.* A, Musorstom 10 1998, Fiji Islands: Stn CP 1369, South of Viti Levu, (scale bar = 1 mm). L = 1.2 mm. **E.** *Meioceras legumen* Hedley, 1899, Stn DW 1381 (scale bar = 1 mm). **F.** *M. magatama* (Habe, 1978), figured holotype (scale bar = 1 mm). L = 1.6 mm. **G.** *M. sandwichensis* Folin, 1881, holotype MNHN (scale bar = 1 mm). L = 1.7 mm. **H.** *M. legumen* Hedley, 1899, lectotype AMS C5693c (scale bar = 1 mm). L = 1.42 mm. **I.** *M. boucheti* Pizzini & Raines, 2011, Stn 1331 (scale bar = 1 mm). L = 1.9 mm. **J.** *M. boucheti* Pizzini & Raines, 2011, the same specimen, septum (scale bar = 200 μm). **K.** *M. amaltheanum* Hedley, 1899, holotype AMS C5692 (scale bar = 500 μm). L = 0.75 mm. **L.** *M. kajiyamai* Habe, 1963, Stn 1240 (scale bar = 1 mm). L = 2.8 mm. **M.** *M. kajiyamai* Habe, 1963, holotype NMNS (scale bar = 1 mm). L = 3.6 mm. **N.** *Micranellum schlangeri* Ladd, 1972, holotype USNM 650430 (scale bar = 1 mm). L = 2.9 mm.

Fig. 15. A. *Caecum vanuatuarum* n. sp., olotipo MNHN, Stn DB 69, Baia di Palikulo, (scala = 1 mm). L = 1,8 mm. **B.** *C. vanuatuarum* n. sp., paratipo MNHN, Santo Marine Biodiversity Survey, 2006, Isole Vanuatu: Stn EP 34, (scala = 1 mm). L = 2 mm. **C.** *C. vanuatuarum* n. sp., paratipo MNHN, Santo Marine Biodiversity Survey, 2006, Isole Vanuatu: Stn EP 34, microscultura (scala = 20 μm). **D.** *C.* sp. A, Musorstom 10 1998, Isole Fiji: Stn CP 1369, Sud di Viti Levu, (scala = 1 mm). L = 1,2 mm. **E.** *Meioceras legumen* Hedley, 1899, Stn DW 1381 (scala = 1 mm). **F.** *M. magatama* (Habe, 1978), olotipo raffigurato (scala = 1 mm). L = 1,6 mm. **G.** *M. sandwichensis* Folin, 1881, olotipo MNHN (scala = 1 mm). L = 1,7 mm. **H.** *M. legumen* Hedley, 1899, lectotipo AMS C5693c (scala = 1 mm). L = 1,42 mm. **I.** *M. boucheti* Pizzini & Raines, 2011, Stn 1331 (scala = 1 mm). L = 1,9 mm. **J.** *M. boucheti* Pizzini & Raines, 2011, stesso esemplare, setto (scala = 200 μm). **K.** *M. amaltheanum* Hedley, 1899, olotipo AMS C5692 (scala = 500 μm). L = 0,75 mm. **L.** *M. kajiyamai* Habe, 1963, Stn 1240 (scala = 1 mm). L = 2,8 mm. **M.** *M. kajiyamai* Habe, 1963, olotipo NMNS (scala = 1 mm). L = 3,6 mm. **N.** *Micranellum schlangeri* Ladd, 1972, olotipo USNM 650430 (scala = 1 mm). L = 2,9 mm.

striation, there are differences regarding the shape of the adapical portion of the tube, more subcylindrical in *Caecum* sp. *B*, and the absence of any kind of longitudinal microsculpture. *Caecum* sp. *B* shows some resemblances with *C. virginiae* n. sp. (**Fig. 9L**) in the shape of septum and apertural varix, but differs from it in sculpture and by the tube bending.

Genus ***Meioceras*** Carpenter, 1858

Type-species

Caecum nitidum Stimpson, 1851 (by subsequent designation, Carpenter, 1859: p. 438) from Caribbean Sea.

Diagnosis

This genus contains species with adult shells having the adapical portion narrow, the middle wider and the abapical contracted. As in genus *Caecum*, *Meioceras* has different growth stages, discarded as the mollusc grows. The protoconch is planispirally coiled with more than one whorl; it is separated from the early teleoconch, twisted to form an open spiral, by a small varix. The first discarded stage is the protoconch and a small piece of the teleoconch still attached (Bandel, 1996). The following growth process is similar to that of genus *Caecum*.

Meioceras legumen (Hedley, 1899)
(Fig. 15E, H)

Caecum legumen Hedley, 1899b: p. 559, fig. 76.
Caecum amaltheanum Hedley, 1899b: p. 559, fig. 75.
Fartulum magatama Habe, 1978: p. 3, pl. 1, figs 7-9.

Type material

C. legumen Hedley, 1899, lectotype herein selected AMS C5693c (**Fig. 15H**), together with paralectotype AMS C5693b.

Type locality

Pava islet (Atoll of Funafuti).

Material examined

The type material and Vauban 1976, south New Caledonia: Stn 40, 250-350 m, 2 sh (juv) *Meioceras legumen* (Hedley, 1899); Musorstom 10, 1998, Fiji Islands: Stn DW 1381, 275-430 m, 3 sh (**Fig. 15E**).

Additional description

Tube pod-shaped, glossy, crossed only by very fine growth striae, gently curved on the dorsal side while the ventral is sometimes nearly straight on its central portion. Septum very pronounced over the cutting plane showing a pointed mucro; in profile, dorsal margin quite straight, ventral one S-shaped. Aperture quite rounded, sometimes oval-flattened. Protoconch, operculum and soft parts unknown. Colour white. Dimensions of the lectotype: length 1.42 mm.

Distribution

Described from Funafuti Atoll, it appears also known from Japan as well (as *Fartulum magatama*). Its geographical distribution is herein extended to Fiji Islands and New Caledonia.

Remarks

For the stability of the nomenclature we selected a lectotype for *M. legumen* (AMS, C5693c, **Fig. 15H**), perfectly fitting the drawing and original description. *Meioceras legumen* is very similar to the figured holotype of *Meioceras magatama* (Habe, 1978) (**Fig. 15F**), whose type material has been destroyed by Byne's disease (Hasegawa, pers. comm.). *Meioceras amaltheanum* (Hedley, 1899) (**Fig. 15K**) is suspected to be the juvenile stage of this species. The most similar species to *M. legumen* is *Meioceras sandwichensis* Folin, 1881, whose type material (MNHN) is rather degraded but still discernible (**Fig. 15G**). In comparison to *M. sandwichensis*, *M. legumen* has the same type of septum, but the general shape is different. *M. sandwichensis* shows an asymmetrical dorsal profile as the ventral side, while *legumen* has a dorsal profile with a regular less emphasized bending and its ventral profile is nearly straight. *M. legumen* is easily recognizable and separable from all the others, but has never been reported by the few authors that have studied this area.

Meioceras boucheti Pizzini & Raines, 2011
(Fig. 15I, J)

Meioceras boucheti Pizzini & Raines, 2011: pp. 42-43, fig. 6I-K.

Type material

Meioceras boucheti Pizzini & Raines, 2011, holotype MNHN 22069 and 1 paratype (sh) from type locality; 1 paratype (sh) (LACM) from Aitutaki (Cook Islands), W side off Arutanga, (18°52.3'S, 159°47.5'W) 18-26 m, rubble & Halimeda, outer reef slope.

Type locality

Tahiti (Society Islands), Arue, 20 m, outer slope, fine rubble and debris.

Material examined

The type material and Musorstom 10, 1998, Fiji Islands: Stn DW 1381, 275-430 m, 1 sh; Exp. Montrouzier Oct. '93, New Caledonia, Koumac Sector NW: Stn 1331, 55-57 m, 1 sh (**Fig. 15I**).

Additional description

Tube pod-shaped, completely smooth, covered only by

very fine growth striae. In profile, initially narrow near the cutting plane, becoming rapidly broader and forming a pronounced gibbosity at about half of the total length, reaching there its maximum diameter and then quickly becoming narrower near the aperture. Dorsal side asymmetrically convex with an obtuse angle almost in the middle, while the ventral is sinuous, with a more or less strong gibbosity in the middle. Septum with sharp mucro receding frontally, inclined by roughly 15-20° with respect to the axis; dorsal side of the mucro initially concave, then becoming slightly convex. Anterior ventral margin first concave, then becoming slightly convex in the middle and again concave near the edge. Aperture simple, sharp, not rimmed, oblique by roughly 30° with respect to the axis. Protoconch, operculum and soft parts unknown. Colour white porcelaneous. Holotype dimensions: length 1.7 mm; superior diam. 0.4 mm; diam in the middle of the tube, 0.7 mm; inferior diam. (aperture): 0.6 mm.

Distribution

Known only from the Society Islands, Fiji Islands, and New Caledonia (Koumac Sector), its distribution is herein extended to Cook Islands (LACM 87-79).

Remarks

Meioceras boucheti shows significant similarities with *M. legumen* Hedley, 1899 (**Fig. 15H**) and *M. sandwichensis* Folin, 1881 (**Fig. 15G**) in the general shape of shell and septum. The last two lack the pronounced gibbosities on both the dorsal and the ventral side, which is the main distinguishing character of *boucheti* (**Fig. 15I**). In fact, with respect to *legumen*, *boucheti* has a more asymmetrical gibbosity both in the dorsal and ventral side, while the dorsal bending of *legumen* is almost circular and even. Also the shape of the septum is different, being less protruding and frontally receding in *boucheti* (**Fig. 15J**). Regarding *sandwichensis*, the main difference consists in the lack of the gibbosities and a more circular curvature with an accentuate asymmetry. Folin (1881) figured the holotype of *sandwichensis* (pl. 1, fig. 10), adult, and a juvenile stage of the same species (pl. 1, fig. 11). The coiled tube of juveniles really represents the main morphological characteristic of this genus. *M. legumen* (Hedley, 1899b) (**Fig. 15H**) and *M. magatama* (Habe, 1978) (**Fig. 15F**) (the latter is suspected to be a junior synonym of the former), have the same septum characters as *sandwichensis*, but among the species of *Meioceras* there are no significant differences in the shape of the septum. In fact, some other *Meioceras* species from Atlantic (Brazil and Caribbean Sea), such as *M. tumidissimum*, *M. bitumidum*, *M. deshayesi*, *M. crossei* (all by Folin, 1869) have similar morphological characters.

Meioceras kajiyamai Habe, 1963 (Fig. 15L, M)

Meioceras kajiyamai Habe, 1963: p. 235, fig. 5.

Micranellum schlangeri Ladd, 1972†: pp. 23-24, pl. 5, figs 13-14 (*syn. nov.*).

Fartulum kajiyamai - Habe, 1978: p. 4.

Type material

Meioceras kajiyamai Habe, 1963, holotype NSMT (**Fig. 15M**).

Type locality

Ankyaba, Kakeroma Jima, an isle near Amami-Oshima (Japan).

Material examined

The type material and *Micranellum schlangeri* Ladd, 1972†, holotype USNM 650430 (**Fig. 15N**) and paratype Museum Comparative Zoology n. 29022; Exp. Montrouzier Sept. '93, New Caledonia, Touho Sector East coast: Stn 1240, 0-2 m, 67 lv and 1 sh; Stn 1269, 15-20 m, 12 sh; Stn 1271, 5-25 m, 5 sh (1 juv.); Stn 1272, 10 m, 3 sh; Stn 1273, 20 m, 2 sh; Exp. Montrouzier Oct. '93, New Caledonia, Koumac Sector NW: Stn 1331, 55-57 m, 1 sh (juv) *M.* cf. *kajiyamai* and 4 sh; Musorstom 10, 1998, Fiji Islands: Stn DW 1381, 275-430 m, *M.* cf. *kajiyamai* 2 sh; Santo Marine Biodiversity Survey 2006, Vanuatu Islands: Stn DB 08, 12 m, 2 sh; Stn DB 20, 22-25 m, 8 sh; Stn DB 67, 7 m, 1 lv and 10 sh; Stn DS 10, 6-24 m, 7 sh; Stn DS 49, 10-17 m, 1 sh; Stn DS 101, 17-19 m, 1 lv and 9 sh; Stn EP 24, 108-121 m, 1 sh; Stn FB 72, 16 m, 1 sh; Stn FB 83, 8-20 m, 1 sh; Stn FS 82, 8-20 m, 7 sh; Stn LD 29, 10-12 m, 1 sh.

Additional material

Many lots (all sh) from Fiji Islands, Papua - New Guinea (all AMS), Australia (WAM), Kwajalein Atoll, inside lagoon at 40 feet (BR), Sudan, Kenya, Zanzibar, Mayotte Is., Seychelles Islands, Srî-Lanka, Philippine Islands, Australia (all MP); Fiji Islands, Papua - New Guinea, Japan (all BR), American Samoa (LACM 1999-89), Indonesia (LACM 88-55).

Additional description

Tube long and oval in profile, with the dorsal side curved and even more curved near the aperture, while the ventral side, initially concave, becomes straight towards the aperture. Surface crossed by about 50 small, slightly raised rings. In ventral view, the septum appears mucronate, with a spatulate tip, inclined by roughly 35° with respect to the vertical axis, protruding over the cutting plane; its posterior margin is nearly straight, while the anterior is slightly convex and with slightly wavy scars, possibly growth striation. Aperture perfectly circular with a sharp edge. Operculum corneous, light brown, noticeably concave; internal surface smooth with the nucleus formed by a raised concretion, white, flowerlike; external surface showing 7-8 concen-

tric small rings, less evident as they get further from the nucleus. Protoconch, operculum and soft parts unknown. Colour light to dark brown in fresh specimens, whitish in beached shells. Dimensions of specimen from Stn 1240, Touho Sector: length 3.6 mm; min. diam. 0.5 mm, max. diam. 0.9 mm.

Distribution

We do not agree with Moore (1976) who assumed that this species, living in the Indo-Pacific area together with *M. sandwicheusis* Folin, 1881 and *M. legumen* (Hedley, 1899) belongs to the Genus *Fartulum*. In our opinion the abovementioned species belong to the *Meioceras*, due to the different growth morphology. Judging from the noticeably findings, *kajiyamai* has a very wide Indo-Pacific distribution, from the coast of Kenya (NMSA-K7984) to all through the SW Pacific.

Remarks

Among the studied material we found only two adults specimens (Musorstom 10, Fiji Islands Stn DW 1381) morphologically identical to those of the nominal species, but notably smaller (length 2.2 mm; width min. 0.4 mm, max. 0.6 mm). In the absence of further data, we refer those two apparently anomalous specimens the *M.* cf. *Kajiyamai*. In our opinion *Micranellum schlangeri* Ladd, 1972 (**Fig. 15N**), a fossil caecid from Early Miocene described for drill hole F-1 Eniwetok (Marshall Islands), is clearly a junior synonym of this species.

Meioceras rhinoceros n. sp.
(Fig. 16A-C)

Type material

Holotype (sh) MNHN 24880 and 1 paratype (sh) MNHN 24881 from type locality; 2 paratypes (sh), AMS C044117 - n. 003958B, Rabaul, New Britain (Papua - New Guinea), 4°12.000'S, 152° 11.000'E, about 1919, leg. Capt. W. Burrows, pres. Capt. W. Burrows, 1919; 1 paratype (sh), LACM 88-55, North Sulawesi, off Menado, S side of Bunaken & Siladen Islets (Indonesia), 1°36.2'N, 124°46.0'E, 5-20 m, rubble of steep coral slope; 1 paratype (sh), Gulf of Tomini, Kep. Togian, Batudaka Is. (Indonesia), 12-17 m (IK).

Type locality

Atelier Lifou 2000, Loyalty Islands: Stn 1456, NE of the Bay, level with Cila, outfall, 20°49.3'S, 167°10.4'E, 25-30 m.

Material examined

The type material and *M. kajiyamai* Habe, 1963, holotype NSMT (**Fig. 15M**).

Description

In profile, the tube appears slightly arched in the dorsal side, while in the ventral side it is nearly straight. In the last one third of its length it reaches its maximum diameter. Microsculpture only consisting of fine growth lines on nearly the whole length of the tube, except for 13-15 faint small rings near the aperture. Positioning the shell frontally with the apex at the top, the mucro resembles a hook, with the curvature and the tip directed to the right side by around 30°- 40°. Aperture circular and oblique at about 45° with respect to the axis of the tube. Protoconch, operculum and soft parts unknown. Colour white in beached shells. Holotype dimensions: length: 6.3 mm; min. diam. 0.9 mm, max. diam. 1.44 mm.

Distribution

Currently known from the Loyalty Islands, Papua - New Guinea and Indonesia.

Etymology

From the Latin *rhinoceros* referred to the shape of the mucro and the very large dimensions, unusual for this family.

Remarks

Meioceras rhinoceros n. sp. (**Fig. 16A-C**) is unique in having large dimensions, never encountered before in the family, and also for its appearance. The sole similar species, limited to the general shape, is *M. kajiyamai* Habe, 1963 (**Fig. 15M**), which differs in many other morphological variables, such as in the shape of mucro, hooked in *rhinoceros*, mucronate with a spatulate tip in *kajiyamai*, and in the tube shape, more straight and without the marked bending in *kajiyamai*. Having found only adult specimens, we do not know the growth stages. The new species is then provisionally placed in the genus *Meioceras*, based on the appearance of the tube.

Subfamily Pedumicrinae Iredale & Laseron, 1957

The subfamily contains the genus *Parastrophia* as well as the genera *Ctiloceras* and *Pouderoceras*. In the Pedumicrinae, the protoconch is not discarded and the last part of larval shell is uncoiled.

Genus *Parastrophia* Folin, 1869

Moreletia Folin, 1869b: vol. 1, p. 122.
Pedumicra Iredale & Laseron, 1957: p. 104.

Type-species

Moreletia cornucopiae Folin, 1869 (by original designation, Folin, 1869b: p. 174) from Pacific Ocean.

Diagnosis

The genus *Parastrophia* contains shells whose protoconch

remains attached to the teleoconchs, unlike the genus *Caecum*. They have a coiled protoconch followed by an uncoiled stage forming a more or less twisted tube. The teleoconch is almost always separated from the uncoiled protoconch by a ring-like varix. Just after the separating varix the teleoconch usually shows microsculpture absent on both the early and late protoconch.

Parastrophia cf. *cornucopiae* (Folin, 1869) (Fig. 16D-G)

Moreletia cornucopiae Folin, 1869b: p. 122, pl. 15, figs 7-9.
Parastrophia filum Melvill, 1906: p. 80, pl. 8, fig. 27.
Parastrophia cornucopiae Moore, 1976: p. 19 (not figured).

Type material

Moreletia cornucopiae Folin, 1869, 3 syntypes MNHN n. 24917 (lectotype herein selected, **Fig. 16F, G**).

Type locality

Hong Kong.

Material examined

The type material and *Spirolidium sumatranum* Thiele, 1925, holotype ZMB/Moll-108515, (**Fig. 16H, I**); *Parastrophia filum* Melvill, 1906, holotype NHMUK 1906.10.23.47 (**Fig. 16M, N**); Bathus 1, 1993, New Caledonia: Stn DW 674, 105-110 m, 1 sh; Exp. Montrouzier Sept. '93, New Caledonia, Touho Sector East coast: Stn 1260, 49-59 m, 6 sh; Stn 1261, 45-56 m, 2 sh; Exp. Montrouzier Oct. '93, New Caledonia, Koumac Sector NW: Stn 1298, 2-4 m, 1 sh; Stn 1299, 12-14 m, 1 sh; Santo Marine Biodiversity Survey 2006, Vanuatu Islands: Stn FB 61, 2-3 m, 1 sh.

Additional material

Only one lot (sh) from New Caledonia (Noumea).

Additional description

Teleoconch smooth, except for a few growth lines; just after the thin separating varix, the diameter of the tube rapidly expands up to half of its length, then gradually decreases a little, reaching the aperture. Most of the specimens show a scar near the aperture, which is simple, circular, oblique and slightly contracted. Dimensions of the New Caledonian shells: length 3.2 mm; min. diam. 0.1 mm, max. diam. 0.6 mm.

Distribution

Known only from Hong Kong, New Caledonia and Vanuatu Islands.

Remarks

All the examined specimens are devoid of the embryonic portion. We are dubious about the statements by Moore (1976) and Hugues (1985a), who consider *Parastrophia sumatrana* (Thiele, 1925) a junior synonym of *Parastrophia cornucopiae*. Primarily because there is clearly a dyscrasia in the shape of abapical portion of the tube of *P. cornucopiae*, and moreover not corresponding to the lectotype, herein selected (**Fig. 16F**), and the original illustration (pl. 15, fig. 7), depicting an adult specimen. Secondly because the dimensions of the lectotype do not allow us to establish the exact point of the narrowing of the tube as in *P. sumatrana* (**Fig. 16H, I**). Furthermore, the other two syntypes of *P. cornucopiae* are too immature and not integral, therefore it is impossible to give a documented opinion on them. For the time being, in absence of evidence, we consider *P. sumatrana* (Thiele, 1925) as a valid species. On the contrary, in our opinion *P. filum* Melvill, 1906 (**Fig. 16M, N**) is a junior synonym of *P. cornucopiae*, having the same shape of both tube and apertural end. Furthermore, we were unable to see the "concentric spiral striation" in the holotype of *P. filum* which was focused on by Melvill.

Parastrophia melanesiana n. sp. (Fig. 16J-L)

Type material

Holotype (sh) MNHN 24882 and 18 paratypes (sh) MNHN 24883 from type locality; Musorstom 10, 1998, Fiji Islands: 6 paratypes (sh) MNHN 24884 Stn DW 1333, 200-215 m; 2 paratypes (one broken) (sh) MNHN 24885 Stn DW 1376, 497-504 m; 4 paratypes (sh) MNHN 24886 Stn DW 1384, 260-305 m; 1 paratype (sh) MNHN 24887 Stn CP 1354, 959-963 m; 1 paratype (sh) MNHN 24888 Stn CP 1363, 144-150 m; 6 paratypes (sh) MNHN 24889 Stn CP 1366, 149-168 m, 149-168 m; 2 paratypes (sh) MNHN 24890 Stn CP 1369, 392-433 m.

Type locality

Musorstom 10, 1998, Fiji Islands: Stn DW 1381, S of Viti Levu, 18°17.8'S, 177°54.4'E, 275-430 m.

Material examined

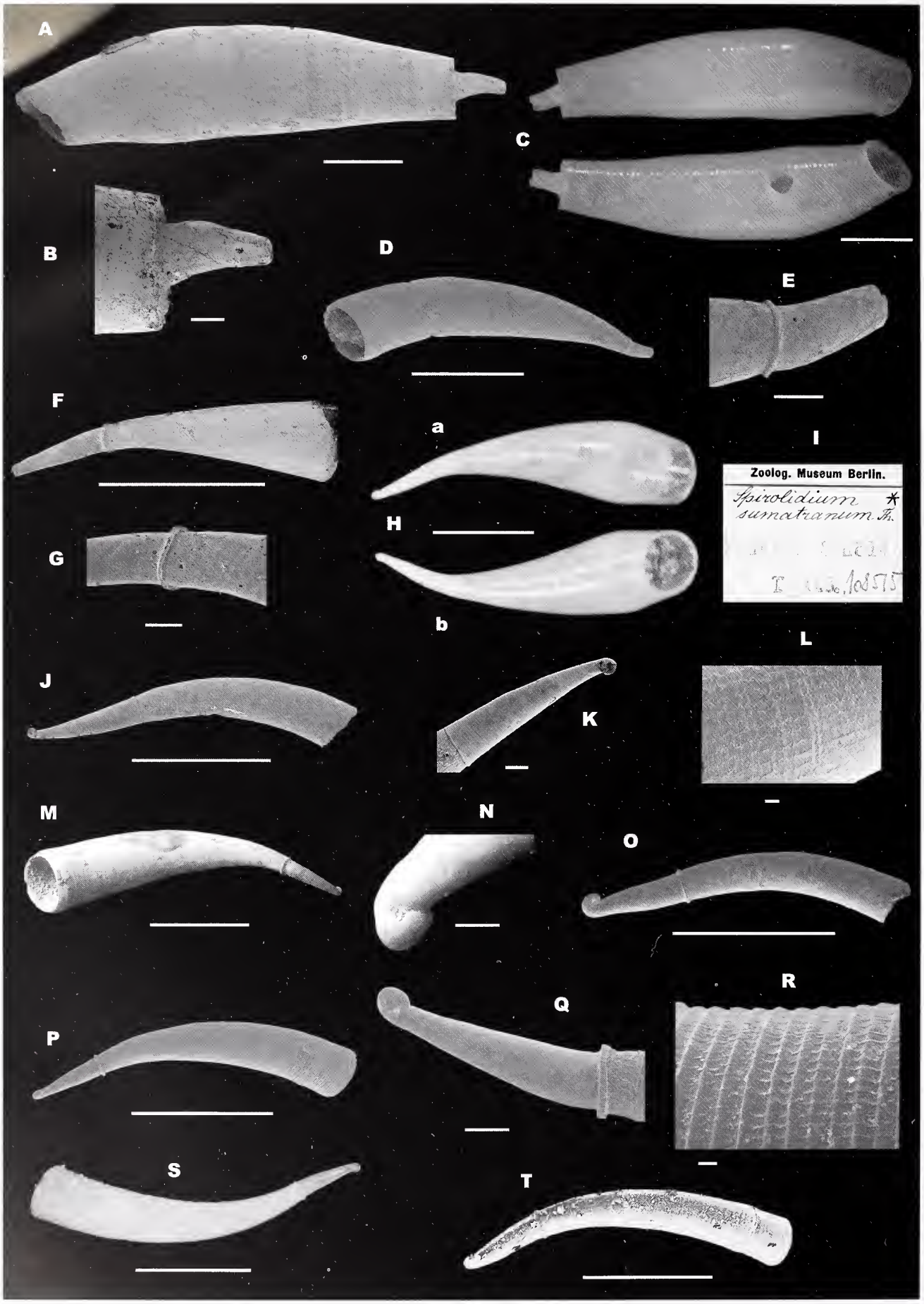
The type material and *P. filum* Melvill, 1906, holotype NHMUK 1906.10.23.47 (**Fig. 16M, N**); *P. japonica* Hinoide & Habe, 1978, holotype, NSMT-Mo 55474 (**Fig. 16S**); 2 paratypes NSMT-Mo 55475, 55476.

Additional material

Only two lots (all sh) from the Philippine Islands (MP) and Papua - New Guinea (BR); *P. cyguicollis* (Hedley, 1904), Western Australia, NE Rottnest Island, in coarse sand grunge at low tide among rocks. Leg. G.T. Watters (BR) (**Fig. 16O**).

Description

Tube bi-sinuous, very thin and tapering. Coiled proto-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conch of less than one whorl, small, ovoid. The uncoiled protoconch is almost straight, completely smooth, except for very weak and fine growth lines, vitreous, transparent; its length is nearly half of the entire shell. It is separated from the teleoconch by a hardly visible varix, like a true demarcation line. The teleoconch just below the separating varix is translucent and characterized by a microsculpture comprised of a zigzag longitudinal striation less visible near the aperture, crossed by sparse and obliquely marked growth lines. Aperture rounded. Operculum and soft parts unknown. Holotype dimensions: length 2.5 mm; min. diam. 0.07 mm, max. diam. 0.38 mm.

Distribution

This species is actually known from the Fiji Islands, Philippine Islands, Thailand and Papua - New Guinea.

Etymology

This species takes its name from the area, Melanesia, from where a large portion of the studied samples originated.

Remarks

Parastrophia melanesiana n. sp. has the same type of longitudinal microsculpture as *P. cygnicollis* (**Fig. 16O**), but differs by its smaller and different separating varix, a smaller oval and squashed coiled protoconch, a longer and tapering late teleoconch. The new species has a coiled protoconch like *P. filum* Melvill, 1906 (**Fig. 16N**), but its shape is almost rounded, while in *filum* is squashed and smaller. *P. melanesiana* n. sp. differs also from *Parastrophia erseusi* Hugues, 1991 (**Fig. 16T**) and *P. japonica* Hinoide & Habe, 1978 (**Fig. 16P**). Compared to the first, the new species has a smaller uncoiled protoconch, more slender and a longitudinal worm-like striation covering the entire teleoconch, completely absent in *P. erseusi*. It differs from *P. japonica*, because the latter shows an uncoiled protoconch consistently shorter and an indistinct and much more pronounced longitudinal striation covering the whole teleoconch. Another species resembling *melanesiana* is *P. queenslandica* (Iredale & Laseron, 1957), which lacks all tube sculpture and has a distinctly different divisional varix.

Parastrophia cf. *japonica* Hinoide & Habe, 1978 (Fig. 16P-R)

Type material

P. japonica Hinoide & Habe, 1978, holotype, NSMT-Mo 55474 (**Fig. 16S**); 2 paratypes NSMT-Mo 55475, 55476.

Type locality

Tsuchihama, Tatsugo-cho, Amami-Oshima in Amami Islands south of Kyushu (Japan).

Material examined

The type material and Bathus 1, 1993, New Caledonia, East coast: Stn DW 674, 105-110 m, 1 sh; Exp. Montrouzier Sept. '93, New Caledonia, Touho Sector East coast: Stn 1260, 49-59 m, 2 sh; Stn 1261, 45-56 m, 1 sh; Stn 1264, 8 m, 1 sh; Exp. Montrouzier Oct. '93, New Caledonia, Koumac Sector NW: Stn 1284, intertidal, 1 sh; Musorstom 10, 1998, Fiji Islands: Stn DW 1333, 200-215 m, 1 sh (quite smooth); Stn DW 1334, 251-257 m, 1 sh; Stn DW 1381, 275-430 m, 4 sh; Stn DW 1384, 260-305 m, 1 sh; Stn CP 1363, 144-150 m, 1 sh; Stn CP 1366, 149-168 m, 1 sh; Stn CP 1369, 392-433 m, 1 sh; Santo Marine Biodiversity Survey 2006, Vanuatu Islands: Stn DB 12, 10-18 m, *P.* cf. *japonica* 1 sh (juv.); Stn DB 40, 5 m, 1 sh; Stn

Fig. 16. A. *Meioceras rhinoceros* n. sp., holotype MNHN, Stn 1456 (scale bar = 1 mm). L = 6.2 mm. **B.** *M. rhinoceros* n. sp., holotype MNHN, Stn 1456, septum (scale bar = 200 μm). **C.** *M. rhinoceros* n. sp., paratype, Gulf of Tomini, Kep. Togian, Batudaka Is. (Indonesia), 12-17 m (IK), (scale bar = 1 mm). **D.** *Parastrophia* cf. *cornucopiae* (Folin, 1869), Stn 1261 (scale bar = 1 mm). L = 2 mm. **E.** *P. cornucopiae* (Folin, 1869), Stn 1261, separation varix (scale bar = 100 μm). **F.** *P. cornucopiae* (Folin, 1869), lectotype MNHN n. 24917 (scale bar = 1 mm). **G.** *P. cornucopiae* (Folin, 1869), lectotype MNHN n. 24917, separation varix (scale bar = 100 μm). **H.** a, b: *Spirolidium sumatranum* Thiele, 1925, holotype ZMB/Moll-108515 (scale bar = 1 mm). L = 3.2 mm. **Fig. 16. I.** *Spirolidium sumatranum* Thiele, 1925, original label. **J.** *P. melanesiana* n. sp., holotype MNHN, Stn DW 1381(scale bar = 1 mm). L = 2.4 mm. **K.** *P. melanesiana* n. sp., holotype MNHN, Stn DW 1381, protoconch (scale bar = 100 μm). **L.** *P. melanesiana* n. sp., holotype MNHN, Stn DW 1381, microsculpture (scale bar = 20 μm). **M.** *P. filum* Melvill, 1906, holotype NHMUK 1906.10.23.47 (scale bar = 1 mm). L = 3.2 mm. **N.** *P. filum* Melvill, 1906, holotype NHMUK 1906.10.23.47, protoconch (scale bar = 50 μm). **O.** *P. cygnicollis* (Hedley, 1904), Western Australia, NE Rottnest Is., Leg. G. T. Watters (BR) (scale bar = 1 mm). L = 2 mm. **P.** *P.* cf. *japonica* Hinoide & Habe, 1978, Santo 2006, Vanuatu Islands, Stn DB 69 (scale bar = 1 mm). L = 2.3 mm. **Q.** *P.* cf. *japonica* Hinoide & Habe, 1978, Santo 2006, Vanuatu Islands, Stn DB 69 (scale bar = 100 μm), protoconch. **R.** *P.* cf. *japonica* Hinoide & Habe, 1978, Santo 2006, Vanuatu Islands, Stn DB 69, microsculpture (scale bar = 20 μm). **S.** *P. japonica* Hinoide & Habe, 1978, holotype NSMT - Mo 55474 (scale bar = 1 mm). L = 2.9 mm. **T.** *P. erseusi* Hugues, 1991, holotype WAM 31-93, orig. fig. (scale bar = 1 mm). L = 2.5 mm.

Fig. 16. A. *Meioceras rhinoceros* n. sp., olotipo MNHN, Stn 1456 (scala = 1 mm). L = 6,2 mm. **B.** *M. rhinoceros* n. sp., olotipo MNHN, Stn 1456, setto (scala = 200 μm). **C.** *M. rhinoceros* n. sp., paratipo, Golfo di Tomini, Kep. Togian, Is. Batudaka (Indonesia), 12-17 m (IK) (scala = 1 mm). **D.** *Parastrophia* cf. *cornucopiae* (Folin, 1869), Stn 1261 (scala = 1 mm). L = 2 mm. **E.** *P. cornucopiae* (Folin, 1869), Stn 1261, varice di separazione (scala = 100 μm). **F.** *P. cornucopiae* (Folin, 1869), lectotipo MNHN n. 24917 (scala = 1 mm). **G.** *P. cornucopiae* (Folin, 1869), lectotipo MNHN n. 24917, varice di separazione (scala = 100 μm). **H.** a, b: *Spirolidium sumatranum* Thiele, 1925, olotipo ZMB/Moll-108515 (scala = 1 mm). L = 3,2 mm. **I.** *Spirolidium sumatranum* Thiele, 1925, cartellino originale. **J.** *P. melanesiana* n. sp., olotipo MNHN, Stn DW 1381(scala = 1 mm). L = 2,4 mm. **K.** *P. melanesiana* n. sp., olotipo MNHN, Stn DW 1381, protoconca (scala = 100 μm). **L.** *P. melanesiana* n. sp., olotipo MNHN, Stn DW 1381, microscultura (scala = 20 μm). **M.** *P. filum* Melvill, 1906, olotipo NHMUK 1906.10.23.47 (scala = 1 mm). L = 3,2 mm. **N.** *P. filum* Melvill, 1906, olotipo NHMUK 1906.10.23.47, protoconca (scala = 50 μm). **O.** *P. cygnicollis* (Hedley, 1904), Australia Occidentale, NE Isola di Rottnest, Leg. G. T. Watters (BR) (scala = 1 mm). L = 2 mm. **P.** *P.* cf. *japonica* Hinoide & Habe, 1978, Santo 2006, Isole Vanuatu, Stn DB 69 (scala = 1 mm). L = 2,3 mm. **Q.** *P.* cf. *japonica* Hinoide & Habe, 1978, Santo 2006, Isole Vanuatu, Stn DB 69 (scala = 100 μm), protoconca. **R.** *P.* cf. *japonica* Hinoide & Habe, 1978, Santo 2006, Isole Vanuatu, Stn DB 69, microscultura (scala = 20 μm). **S.** *P. japonica* Hinoide & Habe, 1978, olotipo NSMT - Mo 55474 (scala = 1 mm). L = 2,9 mm. **T.** *P. erseusi* Hugues, 1991, olotipo WAM 31-93, fig. orig. (scala = 1 mm). L = 2,5 mm.

DB 53, 5 m, 1 sh; Stn DB 69, 38 m, 2 sh; Stn DB 77, 42-45 m, 1 sh; Stn DS 18, 5-10 m, 1 sh; Stn DS 54, 5 m, 1 sh; Stn DS 93, 70 m, 1 sh; Stn DS 105, 92 m, 1 sh; Stn NB 12, 20 m, 1 lv; Stn NS 37, 2-3 m, 2 sh; Stn ZB 06, 30 m, 1 sh.

Additional material

Few lots (all sh) from Fiji Islands, Papua - New Guinea (all AMS), Philippine Islands (MP), Fiji Islands, Papua - New Guinea and Japan (all BR).

Additional description

Coiled protoconch very small, almost ¼ spiral whorl, not planispiral, oval and squashed, compressed against the tube. Turning upwards the early protoconch of the shell it can be observed that the smooth uncoiled protoconch, straight for most of its length, abruptly changes its direction near the separating varix with the teleoconch, turning to the left side. Separation varix small, slightly raised with a reeded edge, like that of a coin longitudinally crenulated. Just below this ring, teleoconch gradually increases its diameter. Sculpture of the teleoconch made up by fine, sinuous, homogeneous and closely packed rings. At high magnification, the tube shows a microsculpture composed of longitudinal lamellae, sometimes placed diagonally, crossing the whole teleoconch, including the tip of the rings. Aperture simple with oblique bending towards the ventral side of the teleoconch with a tendency to contract. This species also tends to form multiple varices on the tube, generally near the aperture. Dimension of the specimen from Stn DB 69: length 2.6 mm.

Distribution

Currently known from New Caledonia (Touho and Koumac Sectors), Fiji Islands, Japan, Papua - New Guinea, Philippine Islands and Vanuatu Islands.

Remarks

The original figures and description of *P. japonica* can be misleading since its teleoconch is said to be "...rather smooth and weakly polished". The original type, however, shows a sculpture consisting of minute homogeneous rings. Because of Byne's disease, it is not possible to determine whether or not a single longitudinal microsculpture exists, though present on our specimens.

P. japonica resembles, in terms of general shape, several Indo-Pacific species: *P. erseusi* Hugues, 1991 (**Fig. 16T**), *P. queenslandica*, (Iredale & Laseron, 1957) (original figure **Fig. 18C**) and *P. cygnicollis* (Hedley, 1904) (**Fig. 18B**). In comparison with the first, which has one and ½ embryonic whorls, *P. japonica* shows just a ¼ whorl, having a much thinner uncoiled protoconch and showing longitudinal microsculpture, absent in *erseusi*.

P. queenslandica lacks any type of sculpture on its tube and has a smaller divisional varix, whose shape is definitely different. The differences are, however, more evident when compared to *P. cygnicollis*, which has a less tapered uncoiled protoconch ending in a very characteristic varix with a shape of a hanging drop. *P. queenslandica* was described erroneously within the genus *Pedumicra* (Iredale & Laseron, 1957: p. 104), without taking into consideration the presence of a varix separating uncoiled protoconch to teleoconch that allows us to place this species in the genus *Parastrophia*.

Parastrophia pulcherrima n. sp.
(Fig. 17A-E)

Fartulum sp. Hugues, 1985a: pp. 158-160, pl. 1B, figs 1j, 2

Type material

Holotype (sh) MNHN 24891 and 1 paratype (sh) MNHN 24892 from type locality; 1 paratype (sh) MNHN 24893 Stn 1260, 20°44'S, 165°14'E, 49-59 m, Channel NE of the Touho ledge, 20°44'S, 165°14'E, shell sand, 49-59 m.

Type locality

Exp. Montrouzier Sept. '93, New Caledonia, Touho Sector East coast: Stn 1259, Touho Bank, 20°44.6'S, 165°13.7'E, outfalls with silt, 15-35 m.

Additional material

2 sh, Queensland, Lizard Is. (Australia), lee side of reef near lagoon entrance at SE side, 14°41'S, 145°27.5'E, coral and rubble slope, 6-15 m, (LACM 79-55); 2 sh, New Territories, Toro Channel, Hoi Sing Wan (Hong Kong), 22°26.1'N, 114°14.8'E, intertidal, cove with sand, rock and oysters, (LACM 85-12); 1 sh, N of Green Is., E of Cairnes, Queensland (Australia), 8 m, shellgrit (MP); 1 paratype (sh), in the sand from a beached *Cassis cornuta* Linné, 1758 (Philippine Islands) (MP).

Description

Tube tri-sinuous, in the first portion until the separation varix, then gradually increasing in diameter, in the second portion much more rapidly. Coiled protoconch of nearly one whorl, smooth. The uncoiled protoconch is glossy, crossed by imperceptible growth striation; the separation varix between uncoiled protoconch and teleoconch has a reeded edge, like that of a coin, with the edge longitudinally crossed by weak parallel riblets. The teleoconch can be divided in two parts, of which each has a different angulation. The first, just after the separation varix, where the tube starts to widen, shows a double torsion within a very short distance; then, the tube widens more rapidly until the aperture, being slightly arched. At this stage, the cross section of the tube becomes oval. As for the microsculpture, the first spiral portion of the teleoconch is crossed by small, parallel, spiral and slightly raised striae following the direction of the tube. The largest portion of the teleoconch has a composite microsculp-

ture being crossed by indistinct growth striae which looks like small rings getting closer to the aperture and intersecting with longitudinal microsculpture crossing both the interspaces and the small rings. Aperture simple. Operculum and soft parts unknown. Colour whitish. Dimensions of the holotype: length 2.3 mm.

Distribution

Only known from South-West Pacific: New Caledonia, Philippine Islands, Australia (LACM 85-12), Hong Kong (Hugues 1985a, *sub nomine Fartulum sp.*) and (LACM 79-55).

Etymology

The name takes origin from the Latin adjective *pulcherrimus* = very beautiful.

Remarks

Hugues (1985a: pp. 158-160, pl. 1, figs B, 1j) presents this species (1 specimen from Port Island and the other from Bay Rock at Ngo Mei Chao, all near Hong Kong) *sub nomine Fartulum sp.* possibly arguing it to be a shell with joined juvenile and adult stages. Bandel (1996) merely reports Hugues' data. We believe it belongs to the genus *Parastrophia*, due to its general morphological characteristics. However the three-angled development of the shell is a new feature among *Parastrophia*, as well as the extremely varied microsculpture in the different portions of teleoconch (**Fig. 17D, E**).

Parastrophia megadattilida n. sp.
(Figs 17F-J, 19L, 21F-H)

Type material

Holotype (lv + operculum) **(Figs 17F, 19L)** MNHN 24894 and 1 paratype (sh) MNHN 24895 from type locality; 3 paratypes (sh) MNHN 24896 Stn DS 99, 100-105 m **(Figs 17I-J)**; 1 paratype (sh) MNHN 24897 Stn DS 104, 80 m; Musorstom 10, 1998, Fiji Islands: 1 paratype (sh) MNHN 24898 Stn DW 1333, 200-215 m; 2 paratypes (sh) MNHN 24899 Stn DW 1334, 251-257 m; 1 paratype (sh) MNHN 24548 Stn DW 1381, 275-430 m.

Type locality

Santo Marine Biodiversity Survey, 2006 - Vanuatu Islands: Stn DS 103, W Tutuba Is., 15°34.1'S, 167°16.0'E, 70-80 m, 14/10/2006.

Material examined

The type material and *Parastrophia challengeri* Folin, 1879 (NHMUK 1991102, Winckworth's collection from Hope Island, northern Australia) (**Fig. 17N, O**); *P. elegans* Folin, 1879, 2 syntypes NHMUK n. 1887.2.9.2311-13 (**Figs 17K-M, 17P**).

Additional material

Only one lot (sh) Papua - New Guinea (BR).

Description

Tube twisted, weakly increasing its diameter. Coiled protoconch of about 1.1 whorls. The uncoiled protoconch is smooth and transparent (paratype Stn. DW 1381), and the separation varix has a reeded edge, showing the external perimeter crossed by a well visible crenulation, perpendicular to the axis of the ring and at regular distances from one another. Sculpture of the teleoconch made up by two kinds of raised rings with a rounded top; in the first portion they are uniform, moderately raised and smaller, with the interspaces almost as wide as the rings, crossed by longitudinal worm-like microsculpture, while in the abapical portion of the tube the rings suddenly become about four times greater in size. Operculum exterior surface quite smooth. Soft parts unknown. Holotype dimensions: length: 4 mm; min. diam. 0.05 mm, max. diam. (aperture) 0.5 mm.

Distribution

Currently known only from Vanuatu Islands, Fiji Islands and Papua - New Guinea.

Etymology

From the Greek μηγα (great) and δαχτυλίδι (ring).

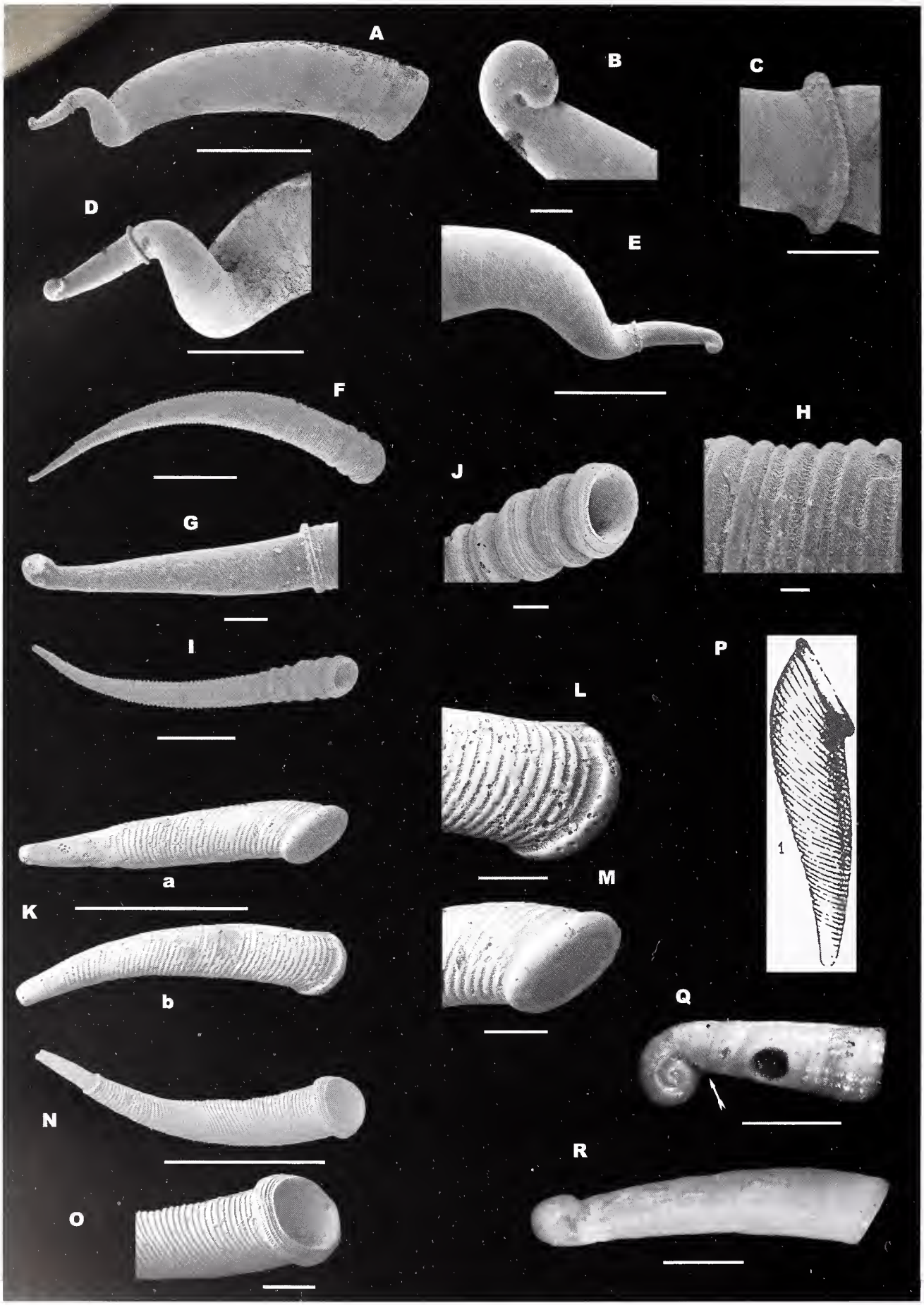
Remarks

Parastrophia megadattilida n. sp. is morphologically very well characterized. The most similar species is *P. elegans* Folin, 1879 (**Figs 17K-M, 17P**), from which the new species can be easily distinguished, being notably thinner and having much larger and pronounced axial rings, especially near the aperture. Furthermore, the aperture of *elegans* shows a strong inclination about 45° with respect to the axis of the tube, while in *megadattilida* it is much accentuated. The two species share the same type of microsculpture, visible in the interspaces, but in *megadattilida* it is less distinct and only present in the abapical portion of the tube.

In the NHMUK a shell labelled *P. challengeri* Folin, 1879 (NHMUK 1991102, Winckworth's coll., from Hope Island, northern Australia) is present (**Fig. 17N, O**). Despite the lack of protoconch, the shell perfectly fits to the type of *P. elegans*.

We think that *Gladioceras armorum* Iredale & Laseron, 1957 (AMS n. C27502) (original figure **Fig. 18Q**), from its morphological characteristics has to be considered a junior synonym of *P. elegans*. In the original drawing of *Gladioceras armorum* in the transparency there seems to be an internal peak more pointed, like a mucro emerging from a septum. However, it is likely a lighting effect of an empty space.

Finally, as regards to *P. challengeri*, it becomes problem-



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atic establishing its identity. In fact, the holotype (NHMUK 1887.2.9.2307, **Fig. 18D**) is so degraded and indiscernible that we were asked by the institution to select a neotype. However, this is impossible at the moment, because of the lack of material for comparison and because the original description is not so clear.

Parastrophia vanuatuensis n. sp. (Fig. 18E-G)

Type material

Holotype (sh) MNHN 24901 from type locality; 2 paratypes (sh) MNHN 24902 Bathus 1, 1993, New Caledonia, East coast, Stn DW 1233, 22°23.5'S, 166°47.6'E, Woodin Channel, 45-50 m.

Type locality

Santo 2006, Vanuatu Islands, Stn FS 74, Strait N Tangoa Is., 15°35.7'S, 166°59.3'E, 12 m, 12/10/2006.

Material examined

The type material and *P. cygnicollis* (Hedley, 1904) (ph) (**Fig. 18B**).

Description

Tube weakly bi-sinuous, gradually increasing in diameter. Coiled protoconch smooth of about one whorl. Uncoiled protoconch smooth and sometimes deformed in the middle. Just below the separating varix the teleoconch is crossed by a sculpture consisting of a large number of very close-set small rings. The entire tube is covered by a very pronounced longitudinal microsculpture crossing both the interspaces and the rings, giving a crenulated look. Operculum and soft parts unknown. Dimensions of the holotype: length: 6.4 mm; min. diam. (coiled protoconch) ca. 0.1 mm, max. diam. (aperture) 0.5 mm.

Distribution

Only known from type locality (Vanuatu Islands) and New Caledonia (East coast).

Etymology

This species is named after the area of type locality (Vanuatu Islands).

Remarks

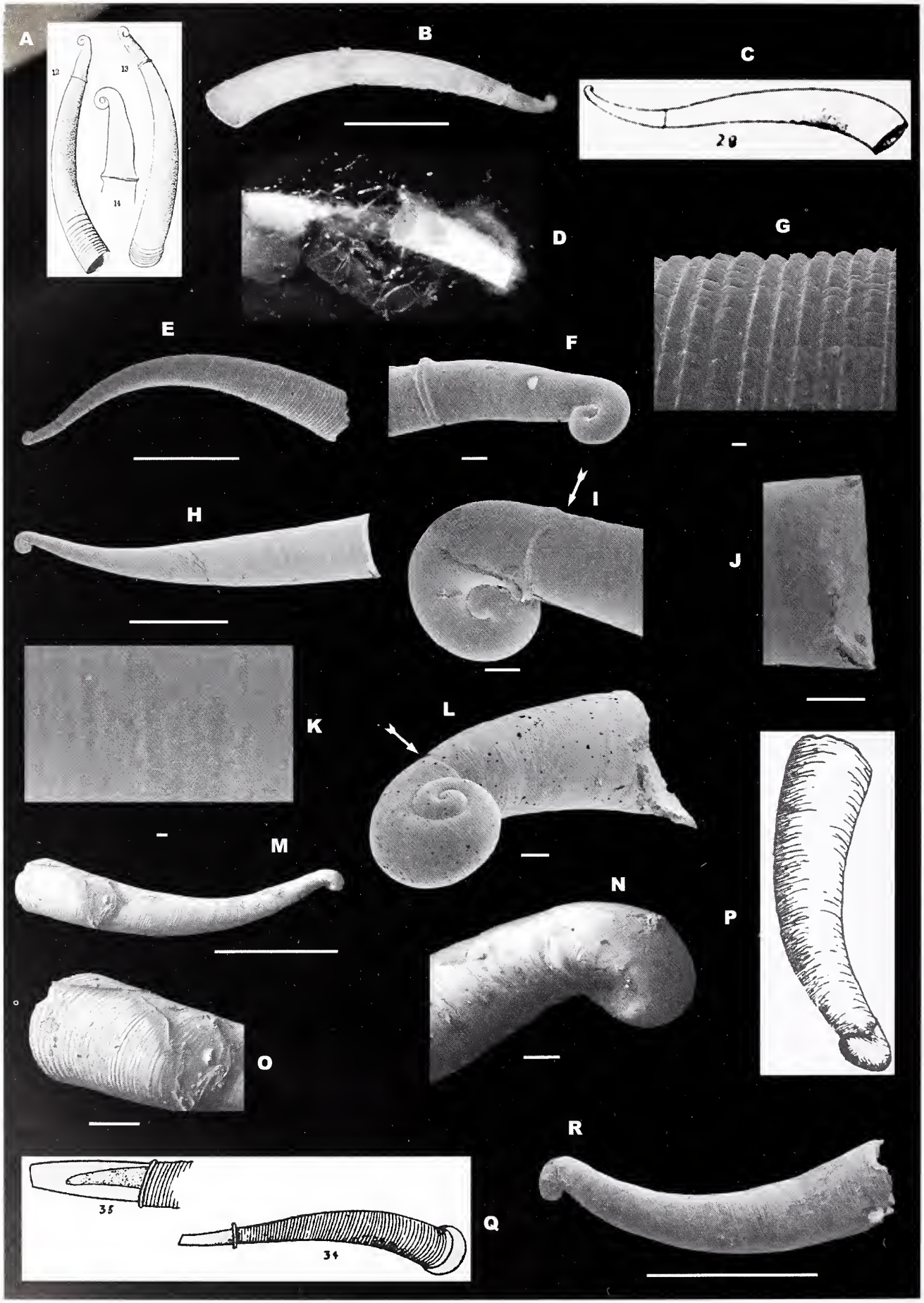
P. cygnicollis (Hedley, 1904) (**Fig. 18A, B**) is the closest species to *P. vanuatuensis* n. sp. (**Fig. 18E-G**) regarding the general shape of the tube, the coiled and uncoiled protoconch, and the shape of the separating varix. *P. cygnicollis*, both fossil and recent, initially described by Hedley (1904: pp. 189-190, tav. 8, figs 12, 14) as pertaining to the genus *Strebloceras*. However, it actually belongs to the genus *Parastrophia*, due to the presence of a varix separating the uncoiled protoconch and teleoconch, which is not present in representatives of the genus *Strebloceras*. The new species differs from *cygnicollis* having a different sculpture of the teleoconch (**Fig. 18G**) consisting of marked axial rings covering the entire teleoconch up to the separating varix, while *cygnicollis* shows a tube "...glassy, translucent". Furthermore the new species has a longitudinal microsculpture crossing the interspaces and the tops of the axial rings (**Fig. 18G**).

Subfamily Strebloceratinae Bandel, 1996

The protoconch is trochospirally or planispirally coiled

Fig. 17. A. *Parastrophia pulcherrima* n. sp., holotype MNHN, Stn 1259 (scale bar = 1 mm). L = 3.5 mm. **B.** *P. pulcherrima* n. sp., holotype MNHN, Stn 1259, protoconch (scale bar = 50 μm). **C.** *P. pulcherrima* n. sp., holotype MNHN, Stn 1259, varix (scale bar = 100 μm). **D.** *P. pulcherrima* n. sp., holotype MNHN, Stn 1259, protoconch, varix and teleoconch (scale bar = μ500 m). **E.** *P. pulcherrima* n. sp. LACM, Australia, Queensland, Lizard Is., protoconch, varix and teleoconch (scale bar = μ500 m). L = 4.3 mm. **F.** *P. megadattilida* n. sp., holotype, Santo 2006, Vanuatu Islands, Stn DS 103 (scale bar = 1 mm). **G.** *P. megadattilida* n. sp., holotype MNHN, Santo 2006, Vanuatu Islands, Stn DS 103, protoconch (scale bar = 100 μm). **H.** *P. megadattilida* n. sp., holotype MNHN, Santo 2006, Vanuatu Islands, Stn DS 103, microsculpture (scale bar = 50 μm). **I.** *P. megadattilida* n. sp., paratype MNHN, Stn DS 99 (scale bar = 1 mm). L = 4.2 mm. **J.** *P. megadattilida* n. sp., paratype MNHN, Stn DS 99, aperture (scale bar = 200 μm). **K.** a, b: *P. elegans* Folin, 1879, holotype NHMUK 1887.2.9.2311 (scale bar = 1 mm). L = 1.9 mm. **Fig. 17. L.** *P. elegans* Folin, 1879, holotype, NHMUK 1887.2.9.2311, aperture (scale bar = 200 μm). **M.** *P. elegans* Folin, 1879, holotype NHMUK, the same aperture from another point of view (scale bar = 200 μm). **N.** *P. challengeri* Folin, 1879, Colln. Winckworths, Hope Is. (Australia) NHMUK 1991102 (scale bar = 1 mm). L = 2.1 mm. **O.** *P. challengeri* Folin, 1879, Colln. Winckworths, Hope Is. (Australia) NHMUK 1991102, aperture (scale bar = 200 μm). **P.** *P. elegans* Folin, 1879, orig. fig. **Q.** *Strebloceras cornuoides* Carpenter, 1859†, paralectotype n. G 72096 NHMUK, Paleontology Section, (scale bar = 1 mm), white arrow indicate the separation between protoconch and teleoconch. **R.** *S. cornuoides* Carpenter, 1859†, lectotype n. G 72096 NHMUK, Paleontology Section, (scale bar = 1 mm).

Fig. 17. A. *Parastrophia pulcherrima* n. sp., olotipo MNHN, Stn 1259 (scala = 1 mm). L = 3,5 mm. **B.** *P. pulcherrima* n. sp., olotipo MNHN, Stn 1259, protoconca (scala = 50 μm). **C.** *P. pulcherrima* n. sp., olotipo MNHN, Stn 1259, varice (scala = 100 μm). **D.** *P. pulcherrima* n. sp., olotipo MNHN, Stn 1259, protoconca, varice e teleoconca (scala = 500 μm). **E.** *P. pulcherrima* n. sp. LACM, Australia, Queensland, Isola Lizard, protoconca, varice e teleoconca (scala = 500 μm). L = 4,3 mm. **F.** *P. megadattilida* n. sp., olotipo, Santo 2006, Isole Vanuatu, Stn DS 103 (scala = 1 mm). **G.** *P. megadattilida* n. sp., olotipo MNHN, Santo 2006, Vanuatu Islands, Stn DS 103, protoconch (scale bar = 100 μm). **H.** *P. megadattilida* n. sp., olotipo MNHN, Santo 2006, Isole Vanuatu, Stn DS 103, microscultura (scala = 50 μm). **I.** *P. megadattilida* n. sp., paratipo MNHN, Stn DS 99 (scala = 1 mm). L = 4,2 mm. **J.** *P. megadattilida* n. sp., paratipo MNHN, Stn DS 99, apertura (scala = 200 μm). **K.** a, b: *P. elegans* Folin, 1879, olotipo NHMUK 1887.2.9.2311 (scala = 1 mm). L = 1,9 mm. **L.** *P. elegans* Folin, 1879, olotipo, NHMUK 1887.2.9.2311, apertura (scala = 200 μm). **M.** *P. elegans* Folin, 1879, olotipo NHMUK, la stessa apertura da altro punto di vista (scala= 200 μm). **N.** *P. challengeri* Folin, 1879, Colln. Winckworths, Isola Hope (Australia) NHMUK 1991102 (scala = 1 mm). L = 2,1 mm. **O.** *P. challengeri* Folin, 1879, Colln. Winckworths, Isola Hope (Australia) NHMUK 1991102, apertura (scala = 200 μm). **P.** *P. elegans* Folin, 1879, fig. orig. **Q.** *Strebloceras cornuoides* Carpenter, 1859†, paralectotipo n. G 72096 NHMUK, Sezione di Paleontologia, (scala = 1 mm) la freccia bianca indica la linea di separazione tra protoconca e teleoconca. **R.** *S. cornuoides* Carpenter, 1859†, lectotipo n. G 72096 NHMUK, Sezione di Paleontologia, (scala = 1 mm).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and remains connected to the uncoiled teleoconch during the entire life-time (Bandel, 1996, *pars*).

Genus ***Strebloceras*** Carpenter, 1859 †

Type-species: *Strebloceras cornuoides* Carpenter, 1859† (by subsequent designation, Finlay, 1931: p. 20). To maintain the stability of the nomenclature, we select the specimen n. G 72096 NHMUK, Paleontology Section within the syntypes of the Edwards colln (Munt & Barker, 1996) from Hampstead Beds, Hamstead, Isle of Wight (UK), Eocene, quoted by Carpenter (1859: 441) as lectotype of *Strebloceras cornuoides* Carpenter, 1859† (**Fig. 17R**).
All of the syntypes are part of the number G 72096 and must be considered as paralectotypes.

Diagnosis

The species belonging to this genus have a protoconch which is more or less trochospirally coiled, with its axis initially oblique in relationship to that of the teleoconch, then tending to become perpendicular during the growth of the teleoconch, which twists rapidly as it grows. The protoconch remains attached directly to the teleoconch during the entire life-time (Bandel, 1996), unlike the genus *Caecum*. The separation between protoconch and teleoconch consists of a more or less marked incised line, visible in all the fossil species (white arrow in **Fig. 17Q**). The teleoconch may be smooth or show a sculpture composed of fine collabral rings, especially visible in its adapical portion.

Remarks

The genus *Strebloceras* was erected by Carpenter (1859: pp. 441, 442) - the date of this work is dual (Carpenter, 1858 [1859]), depending on the date of publication of the releases (K. Way, pers. comm.) - without an explicit type-species indication. Later on Cossmann (1912: p. 155) designated *C. edwardsi* Deshayes, 1864† (Oligocene of Éstampes, southwestern France) as the type-species of the genus *Strebloceras*. However, Finlay (1931) considered Cossmann's designation as invalid since only species originally listed by Carpenter are eligible as type-species and selected the first species described by Carpenter (1859), i.e. *S. cornuoides*, as type-species.
Strebloceras cornuoides Carpenter, 1859†, was probably so named to remember the genus *Cornuoides* Brown† (Brown, 1827: pl. 1, figs 49, 50), based on young specimens of the genus *Caecum*; in fact, Carpenter stated that "As his genus [i.e. *Cornuoides* Brown, 1829] must be expunged, being constituted only for young *Caeca*, the name is retained for the typical species". *Cornuoides* is currently considered as a *nomen dubium* (Gofas, 2012).
This genus contains a few species, ranging all from early Eocene to early Miocene (Carpenter, 1859; Deshayes, 1861-1864; Finlay, 1931; Beu & Maxwell, 1990), with multispiral protoconch and with the separation between proto- and teleoconch consisting of a more or less incised line. On the other hand, the Recent species have a multispiral protoconch showing a sinusigera notch, instead of an incised line. The two groups have in common the planktotrophic development, which could suggest the existence of a single lineage connecting fossil and Recent species. However, the absence of Plio-Pleistocene representatives as well as the presence/absence of sinusigera notch may be the indication that fossil and Recent species may belong to a different lineage and shell shape is the result of convergence.
In this context, even if no specimen of *Strebloceras subannulatum* Folin, 1879 was found in the study material, in order to maintain the stability of the nomenclature, we select also the lectotype of *Strebloceras subannulatum* Folin, 1879, NHMUK n. 1887.2.9.2308, from reefs of Honolulu (**Fig. 18M**).

Strebloceras kilburni n. sp.
(Fig. 18H-K)

Fig. 18. A. *Parastrophia cygnicollis* (Hedley, 1904), orig. fig. **B.** *P. cygnicollis* (Hedley, 1904), holotype AMS C. 17960 (scale bar = 1 mm). L = 3.35 mm. **C.** *P. queenslandica* (Iredale & Laseron, 1957) orig. fig. **D.** *P. challengeri* Folin, 1879, holotype NHMUK 1887.2.9.2307. **E.** *P. vanuatensis* n. sp., holotype MNHN, Santo 2006, Vanuatu Islands, Stn FS 74 (scale bar = 1 mm). L = 3.1 mm. **F.** *P. vanuatensis* n. sp., holotype MNHN, Santo 2006, Vanuatu Islands, Stn FS 74, protoconch (scale bar = 50 μm). **G.** *P. vanuatensis* n. sp., holotype MNHN, Santo 2006, Vanuatu Islands, Stn FS 74, microsculpture, (scale bar = 50 μm). **H.** *Strebloceras kilburni* n. sp., holotype MNHN, Stn 1449 (scale bar = 1 mm). L = 3.75 mm. **I.** *S. kilburni* n. sp., holotype MNHN, Stn 1449, protoconch, (scale bar = 50 μm). **J.** *S. kilburni* n. sp., holotype MNHN, Stn 1449, aperture, (scale bar = 200 μm). **K.** *S. kilburni* n. sp., holotype MNHN, Stn 1449 microsculpture, (scale bar = 10 μm). **L.** *S. hinemoa* Finlay, 1931†, protoconch, Stn 1449 (scale bar = 50 μm). L = 0.58 mm. **M.** *S. subannulatum* (Folin, 1879), lectotype NHMUK MSJ0168 (scale bar = 1 mm). L = 2.7 mm. **N.** *S. subannulatum* (Folin, 1879), lectotype NHMUK MSJ0168 protoconch (scale bar = 50 μm). **O.** *S. subannulatum* (Folin, 1879), lectotype NHMUK MSJ0168, aperture (scale bar = 200 μm). **P.** *S. hinemoa* Finlay, 1931†, orig. fig. **Q.** *Gladioceras armorum* Iredale & Laseron, 1957, holotype AMS n. C27502, orig. fig. **R.** *S. subannulatum* Folin, 1879, Saipan, Laolao Bay (Northern Mariana Islands). Leg. D. Brennan (LACM) (scale bar = 1 mm). L = 2 mm.

Fig. 18. A. *Parastrophia cygnicollis* (Hedley, 1904), fig. orig. **B.** *P. cygnicollis* (Hedley, 1904), olotipo AMS C. 17960 (scala = 1 mm). L = 3,35 mm. **C.** *P. queenslandica* (Iredale & Laseron, 1957) fig. orig. **D.** *P. challengeri* Folin, 1879, olotipo NHMUK 1887.2.9.2307. **E.** *P. vanuatensis* n. sp., olotipo MNHN, Santo 2006, Isole Vanuatu, Stn FS 74 (scala = 1 mm). L = 3,1 mm. **F.** *P. vanuatensis* n. sp., olotipo MNHN, Santo 2006, Isole Vanuatu, Stn FS 74, protoconca (scala = 50 μm). **G.** *P. vanuatensis* n. sp., olotipo MNHN, Santo 2006, Isole Vanuatu, Stn FS 74, microscultura, (scale bar = 50 μm). **H.** *Strebloceras kilburni* n. sp., olotipo MNHN, Stn 1449 (scala = 1 mm). L = 3,75 mm. **I.** *S. kilburni* n. sp., olotipo MNHN, Stn 1449, protoconca, (scala = 50 μm). **J.** *S. kilburni* n. sp., olotipo MNHN, Stn 1449, apertura, (scala = 200 μm). **K.** *S. kilburni* n. sp., olotipo MNHN, Stn 1449 microscultura, (scala = 10 μm). **L.** *S. hinemoa* Finlay, 1931†, protoconca, Stn 1449 (scala = 50 μm). L = 0,58 mm. **M.** *S. subannulatum* (Folin, 1879), lectotipo NHMUK MSJ0168 (scala = 1 mm). L = 2,7 mm. **N.** *S. subannulatum* (Folin, 1879), lectotipo NHMUK MSJ0168 protoconca (scala = 50 μm). **O.** *S. subannulatum* (Folin, 1879), lectotipo NHMUK MSJ0168, apertura (scala = 200 μm). **P.** *S. hinemoa* Finlay, 1931†, fig. orig. **Q.** *Gladioceras armorum* Iredale & Laseron, 1957, olotipo AMS n. C27502, fig. orig. **R.** *S. subannulatum* Folin, 1879, Saipan, Baia Laolao (Nord Isole Marianne) Leg. D. Brennan (LACM) (scala= 1 mm). L = 2 mm.

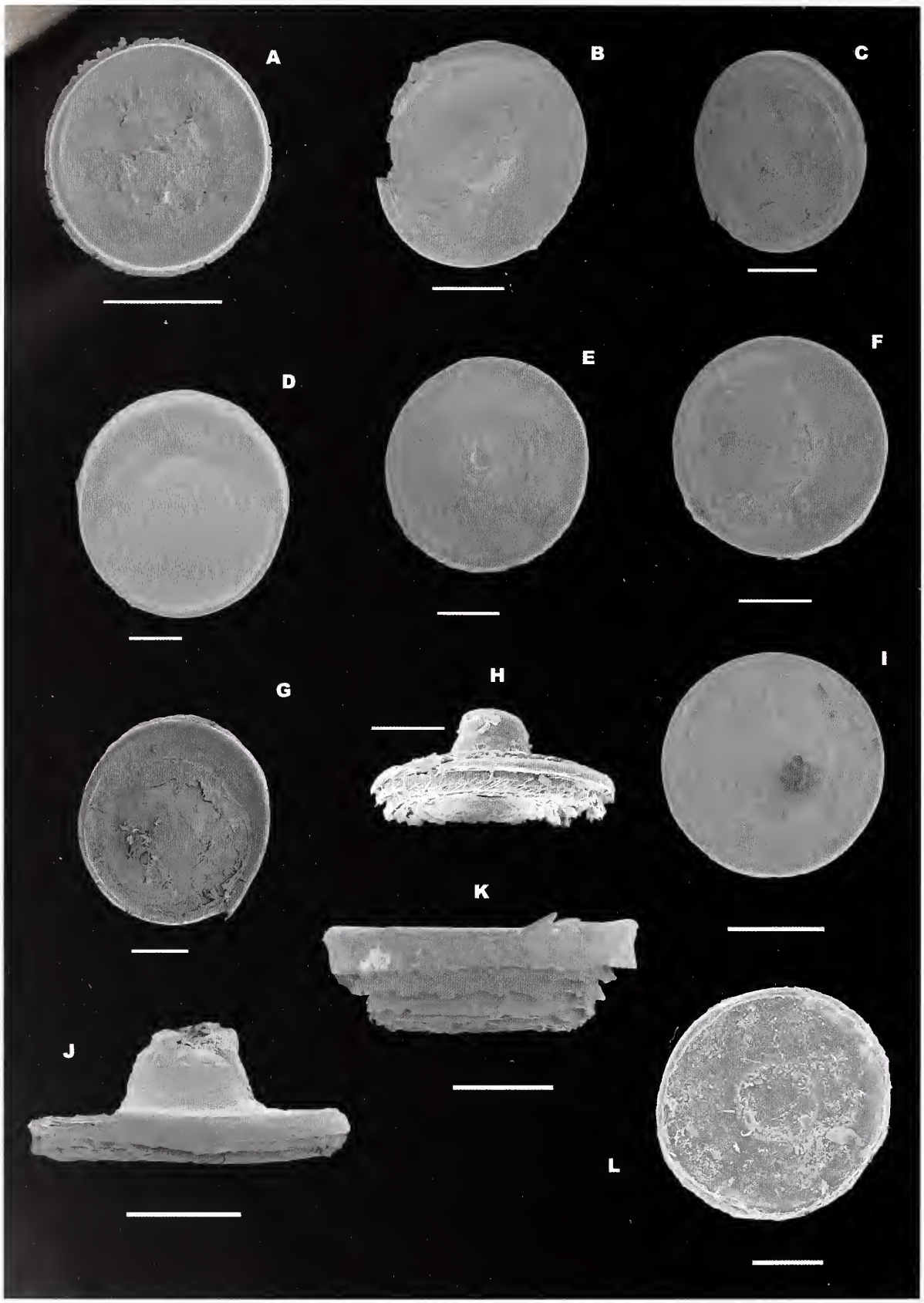

Fig. 19. A. *Caecum fijiense* n. sp , Stn DW 1333 (scale bar = 100 µm). **B.** *C.* cf. *folini* Kisch, 1959, Stn 1412 (scale bar = 100 µm). **C.** *C.* cf. *glabellum* (Carpenter *in* Adams, 1868), Stn 1432 (scale bar = 100 µm). **D.** *C. japonicum* (Habe, 1978), Stn 1240 (scale bar = 100 µm). **E.** *C. modestum* Folin, 1868, Stn 1291(scale bar = 100 µm). **F.** *C. musorstomi* n. sp., Stn 1371(scale bar = 100 µm). **G.** *C. vertebrale* Hedley, 1899, Stn 1457 (scale bar = 100 µm). **H.** *C. neocaledonicum* Folin, 1868, Stn 1457 (scale bar = 100 µm). **I.** *C. succineum* Folin, 1880, Stn 1312 (scale bar = 100 µm). **J.** *C. cooki* Pizzini & Raines, 2011, Stn 1454 (scale bar = 100 µm). **K.** *C. sepimentum* Folin, 1868, Stn 1269 (scale bar = 100 µm). **L.** *Parastrophia megadattilida* n. sp., Stn DS 103 (scale bar = 100 µm).

Fig. 19. A. *Caecum fijiense* n. sp., Stn DW 1333 (scala = 100 µm). **B.** *C.* cf. *folini* Kisch, 1959, Stn 1412 (scala = 100 µm). **C.** *C.* cf. *glabellum* (Carpenter *in* Adams, 1868), Stn 1432 (scala = 100 µm). **D.** *C. japonicum* (Habe, 1978), Stn 1240 (scala = 100 µm). **E.** *C. modestum* Folin, 1868, Stn 1291(scala = 100 µm). **F.** *C. musorstomi* n. sp., Stn 1371(scala = 100 µm). **G.** *C. vertebrale* Hedley, 1899, Stn 1457 (scala = 100 µm). **H.** *C. neocaledonicum* Folin, 1868, Stn 1457 (scala = 100 µm). **I.** *C. succineum* Folin, 1880, Stn 1312 (scala = 100 µm). **J.** *C. cooki* Pizzini & Raines, 2011, Stn 1454 (scala = 100 µm). **K.** *C. sepimentum* Folin, 1868, Stn 1269 (scala = 100 µm). **L.** *Parastrophia megadattilida* n. sp., Stn DS 103 (scala = 100 µm).

Type material

Holotype (sh) MNHN 24903 from type locality.

Type locality

Atelier Lifou 2000, Santal Bay, Loyalty Islands: Stn 1449, N of Cape Aime Martin (= Acadro), brushings, 20°45.8'S, 167° 01.65'E, 17 m.

Description

Coiled protoconch consisting of about 1.1 whorls, planispiral and uniformly growing. Just below the coiled protoconch, a sinuous varix separating it from the teleoconch is noticeable even at low magnification, having a horseshoe shape. Tube quite smooth, slightly twisted and bi-sinuous, enlarges steadily, becoming wider just after the protoconch; microsculpture crossing the entire tube, comprised of fine growth lines becoming more conspicuous in the abapical portion. Aperture simple and round. Operculum and soft parts unknown. Dimensions of the holotype: length 2.1 mm.

Distribution

The species is currently known only from type locality.

Etymology

The species is named after Richard Kilburn, South African malacologist.

Remarks

For the time being, awaiting additional data of what appears to be a new genus, containing all the species sharing the shell characters of *S. kilburni* n. sp., we tentatively place the new species in the genus *Strebloceras*, despite its planispirally coiled protoconch (**Fig. 18I**). On the other hand, the new species lacks the uncoiled protoconch and the correlated ring separating protoconch from teleoconch, which is a defining morphological character of *Strebloceras*. The new species can be included in this genus by its slender form, the more pronounced subcylindrical shape of the tube (**Fig. 18H**) and the lack of the uncoiled protoconch. Furthermore, in *kilburni* the teleoconch is weakly twisted, as in the other representatives of this genus, and completely covered by pronounced growth lines only (**Fig. 18K**).

Strebloceras hinemoa Finlay, 1931 (Fig. 18L)

Strebloceras hinemoa Finlay, 1931†: pp. 21-22, fig. 1.

Type locality

Pukeuri, sandy clays in road-cutting, Awamoan (Early Miocene), New Zealand.

Type material

Not seen.

Material examined

Atelier Lifou, 2000, Loyalty Islands: *Strebloceras hinemoa* Finlay, 1931, Stn 1449, 17 m, 1 sh (fragment) (**Fig. 18L**).

Additional description

Protoconch trochospirally coiled, comprised of nearly 1.8 spiral whorls, separated from the uncoiled portion by a fine and well marked groove. Just below the embryonic whorls, the tube is nearly straight with a diameter that rapidly increases. Microsculpture consisting of minute and sinuous growth lines, visible only at high magnification. Shell milky white. Operculum and soft parts unknown. Dimensions: length, 2 mm.

Distribution

Originally described from New Zealand, its distribution has now been extended though dubitatively to the Loyalty Islands and Northern Mariana Islands (LACM - K11).

Remarks

On the grounds of Finlay's description and original drawing only (**Fig. 18P**) we suppose that this species is probably based on a juvenile specimen. Among the material herein studied a single juvenile shell has been found and attributed to this species based on the characteristics of protoconch (**Fig. 18L**). The differences between *Strebloceras subannulatum* and *Strebloceras hinemoa* Finlay, 1931 are subtle. Both have the same number of embryonic whorls, but the protoconch of *hinemoa* is slightly bigger, the initial torsion of its teleoconch is more abrupt, the diameter of the tube increases much slowly and it shows indistinct growth lines only, not extremely small rings as they appear in *Strebloceras subannulatum* (Folin, 1879) (**Fig. 18R**).

Conclusions

Regarding the family Caecidae, the Indo-Pacific Province, including Japanese Province, though the largest area in absolute terms, is surely the one least studied, accounting for only fifty-eight species currently known, compared with the approximatively seventy of the smaller Caribbean Province.

From the present study, it is clear that despite the difference between regions, the family Caecidae is well represented in almost the entire New Caledonian region and in particular in New Caledonia and Fiji Islands.

The high number of species found in the New Caledonian area, confirms, even for the family Caecidae, what was pointed out by Bouchet et al. (2002) about its great abundance of molluscs particularly in coral reef environments. In addition, this study also brought to light a

wider South-West Pacific distribution range of such species as Caecum sepimentum, C. modestum, C. neocaledonicum, C. japonicum and Meioceras kajiyamai.

Grande Terre (62 stations) (**Fig. 2**), the largest of the many islands comprising New Caledonia, is the second area after Vanuatu Islands (92 stations) where most of the dredgings have taken place. This area is completely surrounded and protected by a coral-built rim 100 to 1000 m in width, except in the south-eastern coast, where it is partly submerged or absent. It is a nearly continuous barrier reef, from 1 to 70 km from the coast. The barrier shelters a lagoon, with an average depth of 25 m in the west and 40 m in the east, dropping to a maximum depth of 80 m. The outer slope drops gently down to a depth of 20 m, then plunges downwards in a succession of near-vertical slopes and platforms.

A wide variety of ecosystems are present in this area, such as coral reefs (second largest in the world), mangroves, and seagrass beds. Among these ecosystems, the coral reef is the one with most abundant species, particularly near New Caledonia, almost at the epicentre of the greatest biodiversity. The ecosystems made up of seagrass beds are not well known, except those in the south-western lagoon (Garrigue, 1995). They are mainly present in the shallower areas of the lagoon floor, on the deep silty coastal lagoon bottoms, on coastal shallows (< 5 m) and around islets.

These ecosystems, particularly developed in the west and south-west of New Caledonia, provide the best habitat for Caecidae, which live at a depth varying from ca. 0 to 100 m, as can be seen from both the rather high number of species and the number of species captured alive or with operculum (**Tab. 1**).

In the Noumea SW Sector, a great majority of species, even with few specimens on hand, had soft parts and/or operculum (Stn 1351 = 100%; Stn 1371 = 99%), which is a good indicator of the favorite ecosystems of the Caecidae, that is intertidal, grunge (Stn 1351) and reef (Stn 1371).

Koumac Sector has the highest density of species (≥ 3) at Stns 1277 (8 sp., soft bottoms, seagrasses), 1279 (4 sp., tide line, hard bottoms, seagrasses), 1284 (8 sp., tide line, mixed substrate), 1289 (4 sp., tide line, reef flat with blocks), 1292 (7 sp., tide, soft bottom), 1298 (3 sp., hard bottoms), 1299 (5 sp., slab with gorgones), 1300 (3 sp., gray silty sand), 1303 (3 sp., muddy sand with blocks), 1310 (4 sp., hard bottoms); 1331 (5 sp., outer slope) representing 50 % of the total number of the stations (22).

Furthermore, this sector has percentage-wise the highest density of live collected specimens referring to the only two species found in abundance, *C. modestum* and *C. sepimentum* at stations 1277 (*modestum* 248 lv), 1292 (*modestum* 51 lv), 1310 (*sepimentum* 51 lv), 1312 (*sepimentum* 55 lv + 10 lv in alcohol), 1316 (*sepimentum* 36 lv), 1318 (*sepimentum* 87 lv + 8 lv in alcohol) and 1319 (*sepimentum* 28 lv + 1 lv in alcohol). They are living in somewhat shallow waters characterized by diversified microhabitats completely different than those of the Noumea Sector.

From another point of view, ca. 36% overlaps of the abovementioned 11 stations compared with those with a higher specific density, that are 1277, 1279, 1284, 1289, 1292, 1299, 1310 and 1331 can be noticed.

In our opinion more dredgings in the remaining 50% of those stations with microhabitats containing only a few species of Caecidae (< 3), could clarify this discrepancy and further prove the proposition "we have not reached saturation of the species richness" (Bouchet et al., 2002; p. 425).

The eastern side of New Caledonia (Canala Sector, Bathus 1 and Touho Sector, Exps.) (**Tab. 1**) is also surrounded by coral reef barriers. At the south, coral reef barriers are discontinued because they are either covered by water or at a point of being non existent. Nevertheless, the somewhat shallow waters (max. depth 56 m), determine favourable environmental conditions similar to those found in the west. The number of species in this sector is 20, five of which are new (*C. maestratii*, *C. microstriatum*, *C. musorstomi*, *P. pulcherrima* and *P. vanuatensis*) representing 25% of the amount.

The diversity of species is noticeable especially at stations 1240 (6 sp.), 1259 (6 sp.), 1260 (11 sp. and 1 undetermined), 1261 (6 sp.) and 1264 (9 sp.) with different microhabitats but nearly all with empty shells, whereas station 1240 (sheltered flats, sand, seagrass), though with a lower number of species, had 90% of the live collected specimens. The highest density of live collected specimens wrapped up few species as *C. modestum*, *C. sepimentum*, *C. japonicum* and *M. kajiyamai* was found at stations 1240 (*japonicum*, 410 lv; *kajiyamai*, 67 lv; *modestum*, 22 lv), 1242 (*japonicum*, 162 lv; *modestum*, 68 lv), 1253 (*japonicum*, 70 lv), 1255 (*japonicum*, 23 lv), 1264 (*japonicum*, 75 lv), 1266 (*japonicum*, 58 lv), 1271 (*japonicum*, 52 lv), 1272 (*japonicum*, 51 lv), 1273 (*sepimentum*, 12 lv), representing an indicator of a good adaptation of the Caecidae in the abovementioned stations.

Between Koumac Sector (NW side) and Touho Sector (E side) (**Tab. 1**) a remarkable overlapping of species is noticeable with sixteen of the seventeen species present in the western area.

South of Grande Terre (Exps. Vauban 1976, Vauban 1978/79, Smib 8) seems to be not particularly significant due to the only three stations with dredgings made at prohibitive depths for the life of Caecidae (depth range 250-510 m) (**Tab. 1**); in fact all the dredged specimens lack operculum and soft parts. However the finding of five species, of which one is new, in the abovementioned unfavourable conditions, lead us to surmise it may have come from the shallower depths of the infralitoral zones, not investigated.

On the contrary, SW of Grande Terre (Campagne Lagon SW, 1992) has a depth ranging 15-20 m, more sheltered with terrigenous supplies, which is the most favorable ecosystem for living Caecidae (**Tab. 1**). The geomorphology of this zone consisting mainly by a barrier reef 400-500 m wide, weakens the effect of the swell and stops the sedimentary transit toward the open sea, by a sandy shore 5-10 m wide with a slight slope toward the lagoon, by a hard bottoms zone ranging 13-20 m, and

by a littoral zone surrounded by a fringing crown reef (Labails, 1999: 25-26, fig. 21).

South-west of Grande Terre together with Touho E Sector (depth range 0-59 m), and Koumac NW Sector (depth range 0-57 m) represent the Caledonian ecosystems most favorable to living Caecidae. Moreover, 9 species have to be added herein to the 18 provided by Pizzini & Nofroni, quoted by Héros et al. (2007: 208). The entire Caledonian Region covering ca. 295 Km^2, yielded 27 species, of which 8 are new, representing ca. 59% of the total (45) (**Tab. 1**). These numbers are a good indicator of the biodiversity in this region.

The Loyalty Islands (**Fig. 2**) consisting of Ouvéa, Lifou, Maré, the volcanic islands of Matthew and Hunter, and some other smaller islands at about 100 km off the east coast of Grande Terre; all have fringing reefs, except Ouvéa, which is a partially submerged atoll. However, these islands are surrounded by a lagoon, the Lifou reefs descending directly into deep open sea.

The main biotopes are coral-reef formations and the lagoon bottoms: those inhabiting silty bottoms, those on the grey sand beds of the lagoon floor, and those on the white sand beds in the sheltered reef area. Another biotope of the Loyalty Islands consists of some less extensive mangrove areas, particularly Ouvéa. The dominant groups in terms of numbers are molluscs, sponges and echinoderms.

Despite Lifou being the only island sampled, we feel that the specimens found at the 31 stations where dredging took place are enough to give a rather satisfying picture of the Caecidae within the archipelago which immediately presents differences compared with New Caledonia. Most of the samples (15 stations) were dredged at a depth ranging 8 to 32 m, mostly in a coral environment whereas at 13 stations the depth was ranging 2 to 10 m with diversified intertidal microhabitats (**Tab. 2**).

Among three stations (1442, 1459, 1462) with samples taken at a depth ranging 47-120 m (dredgings and outfalls), only the first (base of outfall, depth 47 m) had more species with 4 species. In total, 18 species were found, of which three are new (*C. loyalteuse*, *Meioceras rhinoceros* and *Strebloceras kilburni*). Among them only *Meioceras rhinoceros* n. sp. is also present in Papua - New Guinea (AMS, 2 sh) and Indonesia. The finding of seven living species (ca. 39%) leads us to surmise that the Caecidae has adapted very well in this archipelago.

Four species with a very wide Indo-Pacific dispersion are present, these are *C. neocaledonicum*, *C. sepimentum*, *C. japonicum* and *C. vertebrale*. The results from the data concerning the family Caecidae indicate that Loyalty Islands make up an archipelago with peculiar characteristics such as a noticeable abundance of species in comparison to a considerable rarefaction in terms of specimens. Furthermore, a similarity of species compared with New Caledonia is noticeable with nine of these overlapping with the east coast of Grande Terre compared with only five in the west coast. The number of species is considerable, whereas the number of specimens is rather low considering the shallow waters, which is favorable to Caecidae, and that more than half of these were found with soft parts and operculum.

The Fiji Islands (Musorstom 10 Exp., 1998, depth range 144-963 m; Bordau 1 Exp., Feb. - Mar. 1999) (**Fig. 4**) are made up of over 300 islands and their waters contain a high diversity of marine habitats, including coral reefs, lagoons, mangrove forests, seaweed communities, seagrass beds, sandy shores and estuaries. From a biodiversity standpoint scientists (Zann, 1992) recognise Fijian coral reefs as having a high ecological significance, rich in anemones, sponges, molluscs, ascidians, crustaceans, polychaete worms, platyhelminthes, and echinoderms. Seagrass beds and large concentrations of mangrove forests also provide habitat and nursery areas for fish and invertebrates, stabilizing the sediments and play a role in the recycling of nutrients. In the presence of such diverse and variegated infra-coastal habitats, we would have expected a rather high number of live collected specimens. The Fiji Islands, with ca. 38%, were the most rich in terms of number of new species (9) in comparison to the total number (26), but with only 4 species collected with soft parts (*C. sepimentum*, *C.* cf. *inflatum*, *C. japonicum* and *C. fijiense* n. sp.). Given that all the depths were far too deep for normal Caecidae survival, we surmise the specimens might have slid along an escarpment (**Tab. 3**). This again leads us to believe that the number of Caecidae is likely to be much higher in the infra coastal areas of these islands, which are not sufficiently investigated. With more focused dredging, more Caecidae may be found both in terms of number and new species. The Vanuatu Islands (Musorstom 8, 1994 and Santo 2006 Expeditions) (**Fig. 3**) are an archipelago consisting of 83 volcanic islands richer in sea life, and considered the southeastern part of a region with the highest marine biodiversity known as coral triangle (Bouchet et al., 2006; Lane & Rowe, 2006) (**Tab. 4**).

Concerning Wallis Islands (Musorstom 7 Exp., 1992) (**Fig. 6**) (**Tab. 5**) and Philippine Islands (Musorstom 3 Exp., 1985) (**Fig. 5**) (**Tab. 6**), as of yet we do not have enough examples to make an evaluation given there are only two stations.

Erratum

A closer examination of the specimen attributed to *Caecum* cf. *campanulatum* Raines & Pizzini, 2005 (p. 23, Fig. 11B) permitted to conclude that it is conspecific with *Caecum bounty* Pizzini & Raines, 2011 described from French Polynesia, therefore the range of the latter is extended to Fiji Islands.

Aknowledgements

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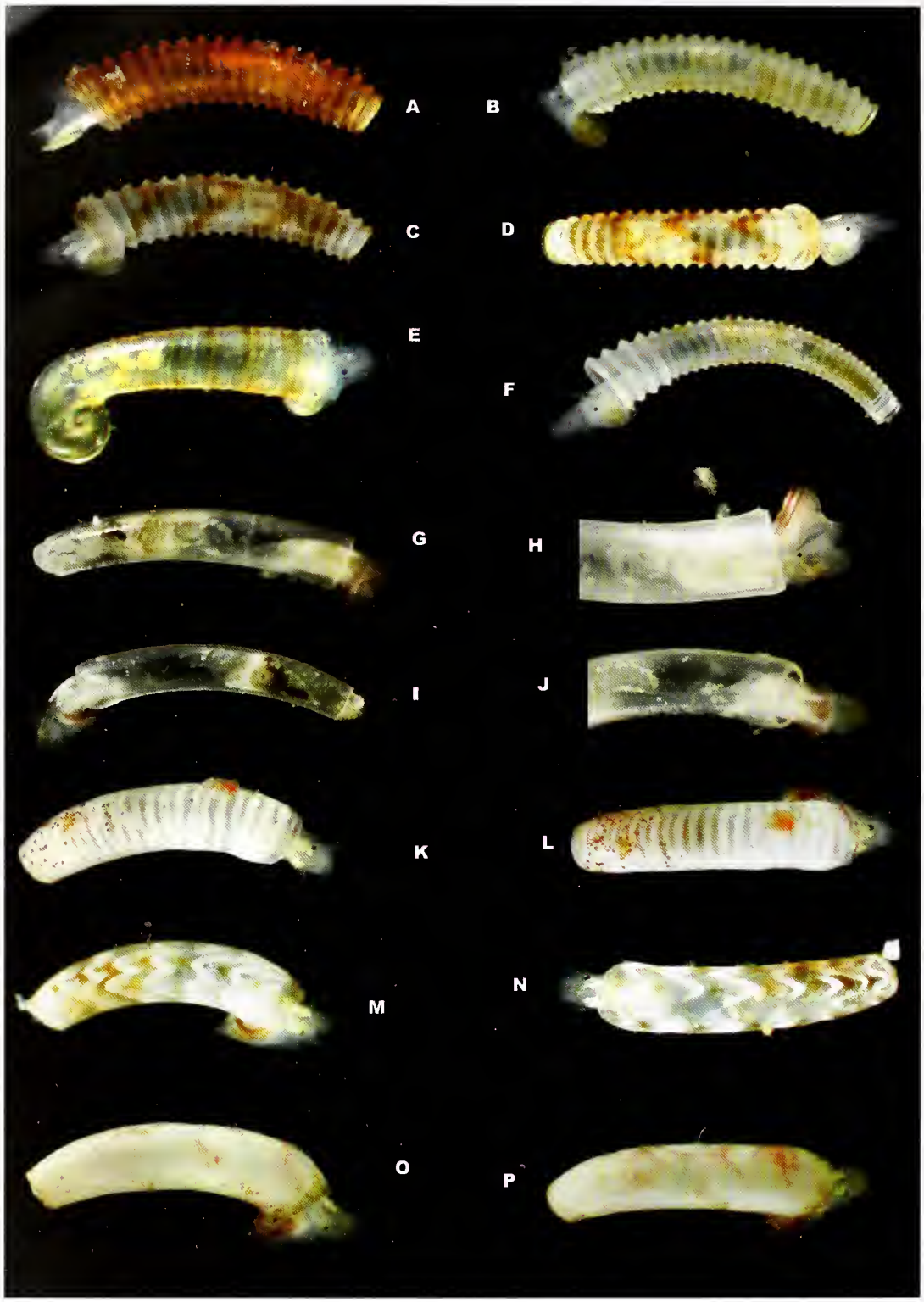

Fig. 20. A. *Caecum sepimentum* Folin, 1868, Stn ZB 9, emerging from the shell, lateral view. **B.** *C. sepimentum* Folin, 1868, Stn DB 53, the same action. **C.** *C. sepimentum* Folin, 1868, Stn FP 46, the same action, a different colouration. **D.** *C. sepimentum* Folin, 1868, Stn FP 46, the same specimen, from above. **E.** *C. sepimentum* Folin, 1868, Stn EP 21, larval stage, lateral view, both the eyes (black spots), foot, tentacles and fecal pellets are visible. **F.** *C. sepimentum* Folin, 1868, Stn NB 12, juvenile, lateral view. **G.** *C.* cf. *attenuatum* Folin, 1880, Stn DSCN 2615, lateral view. **H.** *C.* cf. *attenuatum* Folin, 1880, Stn DSCN 2626, aperture. **I.** *C.* sp., Stn DSCN 2616, lateral view. **J.** *C.* sp., Stn DSCN 2624, aperture. **K.** *C. japonicum* (Habe, 1978), Stn DB 53, parallel dark stripes pattern, lateral view. **L.** *C. japonicum* (Habe, 1978), Stn DB 53, the same specimen from above. **M.** *C. japonicum* (Habe, 1978), Stn ED 17, zig-zag pattern colour variant, lateral view. **N.** *C. japonicum* (Habe, 1978), Stn DB 14, zig-zag pattern colour variant; external organs: buccal mass, tentacles and eyes. **O.** *C. japonicum* (Habe, 1978), Stn DB 53, light brown colour. **P.** *C. japonicum* (Habe, 1978), Stn DB 53, light brown colour, from above.

Fig. 20. A. *Caecum sepimentum* Folin, 1868, Stn ZB 9, il mollusco comincia ad uscire dal tubo, vista laterale. **B.** *C. sepimentum* Folin, 1868, Stn DB 53, la stessa azione. **C.** *C. sepimentum* Folin, 1868, Stn FP 46, la stessa azione, colorazione differente. **D.** *C. sepimentum* Folin, 1868, Stn FP 46, lo stesso esemplare, vista dall'alto. **E.** *C. sepimentum* Folin, 1868, Stn EP 21, stadio larvale, vista laterale, visibili entrambi gli occhi (puntini neri), il piede, i tentacoli e le pallottole fecali. **F.** *C. sepimentum* Folin, 1868, Stn NB 12, giovanile, vista lateral. **G.** *C.* cf. *attenuatum* Folin, 1880, Stn DSCN 2615, vista laterale. **H.** *C.* cf. *attenuatum* Folin, 1880, Stn DSCN 2626, apertura. **I.** *C.* sp., Stn DSCN 2616, vista laterale. **J.** *C.* sp., Stn DSCN 2624, apertura. **K.** *C. japonicum* (Habe, 1978), Stn DB 53, colorazione a strisce scure parallele, vista laterale. **L.** *C. japonicum* (Habe, 1978), Stn DB 53, stesso esemplare visto dall'alto. **M.** *C. japonicum* (Habe, 1978), Stn ED 17, variazione di colorazione a motivi zig-zag, lateral view. **N.** *C. japonicum* (Habe, 1978), Stn DB 14, colorazione con motivi a zig-zag; organi esterni: massa buccale, tentacoli e occhi. **O.** *C. japonicum* (Habe, 1978), Stn DB 53, colorazione beige uniforme. **P.** *C. japonicum* (Habe, 1978), Stn DB 53, colorazione beige uniforme, da sopra.

Fig. 21. A. *Caecum neocaledonicum* Folin, 1868, Stn VM 46, reddish colour due to the periostracum. **B.** *C. neocaledonicum* Folin, 1868, Stn VM 46, reddish colour variant. **C.** *C.* cf. *modestum* Folin, 1868, Stn LD 09, internal organs: stomach, gonad, penis; external organs: buccal mass, eyes, foot, tentacles and operculum. **D.** *C.* cf. *modestum* Folin, 1868, Stn DB 53, external organs: buccal mass, eyes, foot, tentacles and operculum. **E.** Group of *Caecum*, Stn DB 53: *C. sepimentum*, *C. japonicum* two specimens to the right side with different colouration pattern, *C.* cf. *modestum* to the left. **F.** *Parastrophia megadattilida* n. sp., Stn DSCN 5134. **G.** *P. megadattilida* n. sp., Stn DS 103. **H.** *P. megadattilida* n. sp., Stn DS 103.

Fig. 21. A. *Caecum neocaledonicum* Folin, 1868, Stn VM 46, colorazione rossiccia dovuta al periostraco; organi esterni: massa buccale, occhi, piede, tentacoli e opercolo. **B.** *C. neocaledonicum* Folin, 1868, Stn VM 46, colorazione rossiccia. **C.** *C.* cf. *modestum* Folin, 1868, Stn LD 09, organi interni: stomaco, testicolo, pene; organi esterni: massa buccale, piede, tentacoli e opercolo. **D.** *C.* cf. *modestum* Folin, 1868, Stn DB 53, organi esterni: massa buccale, occhi, piede, tentacoli e opercolo. **E.** Gruppo di *Caecum*, Stn DB 53: *C. sepimentum*, *C. japonicum* a destra, due esemplari con differente colorazione, a sinistra, *C.* cf. *modestum*. **F.** *Parastrophia megadattilida* n. sp., Stn DSCN 5134. **G.** *P. megadattilida* n. sp., Stn DS 103. **H.** *P. megadattilida* n. sp., Stn DS 103.

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Tab. 1.

species	station	depth range	live= lv; dead = sh; lar = larval shell
Vauban Exp. 1976 - New Caledonia South			
C. amamiense	40	250-350 m	1 sh
C. sepimentum	40	250-350 m	30 sh
C. vertebrale	40	250-350 m	1 sh
M. legumen	40	250-350 m	2 sh (juv.)
Vauban Exp. 1978/79 - New Caledonia South			
C. sepimentum	2	425-430 m	1 sh
C. vertebrale	2	425-430 m	1 sh
Orstom 1987 - New Caledonia, Canala Sector, East Coast			
C. sepimentum	748	35 m	1 sh
Campagne Lagon, 1992 - New Caledonia, Nouméa Sector SW			
C. japonicum	1351 1355 1367 1371	intertidal 7-10 m 10 m 12-16 m	12 lv 1 lv 1 lv 50 lv + 5 sh (lar)
C. modestum	1351	intertidal	10 lv + 4 sh
C. musorstomi n. sp.	1351 1355 1367 1371	intertidal 7-10 m 10 m 12-16 m	1 lv 1 lv 3 sh cf 1 lv + 6 sh + 1 juv.
C. neocaledonicum	1351	intertidal	8 lv + 1 sh
C. succineum	1371	12-16 m	1 sh
C. sepimentum	1351 1352 1371	Intertidal 12-37 m 12-16 m	1 lv + 2 sh 5 lv (alc) 7 lv + 1 sh
C. succineum	1371	12-16 m	1 sh
Smib 8, Jan. - Feb. 1993 - S New Caledonia, sponge bank (Mont B)			
C. bathus **n. sp.**	DW 148	510 m	1 sh
Bathus 1, 1993 - New Caledonia East Coast			
C. cf. *gulosum*	DW 1233	45-50 m	1 sh
C. japonicum	DW 1233	45-50 m	1 lv + 17 sh
C. mauritianum	DW 654	237-298 m	1 sh
C. musorstomi n. sp.	DW 1233	45-50 m	1 lv + 17 sh
C. sepimentum	DW 1233 DW 683	45-50 m 380-400 m	1 sh 1 sh (juv)
P. cf. *cornucopiae*	DW 674	105-110 m	1 sh
P. cf. *japonica*	DW 674	105-110 m	1 sh
P. vanuatuensis n. sp.	DW 1233	45-50 m	2 sh
Bathus 2, 1993 - SW New Caledonia			
C. cf. *glabellum*	CP 755	495 m	1 sh
Bathus 3, Nov.- Dec. 1993 - New Caledonia, Norfolk Ridge			
C. bathus n. sp.	DW 778 DW 809 DW 827	750-760 m 650-730 m 381-469 m	1 sh 1 sh 1 sh

Montrouzier Exp. Sept. '93 - New Caledonia, Touho Sector East Coast			
C. amamiense	1269	15-20 m	1 sh
	1271	5-25 m	3 sh
	1272	10 m	2 sh
C. clarum	1240	0-2 m	1 sh
C. cooki	1260	49-59 m	1 sh
C. cf. *folini*	1260	49-59 m	4 sh
C. cf. *gulosum*	1264	8 m	1 sh
C. japonicum	1239	-	1 lv + 1 sh
	1240	0.2 m	410 lv + 7 sh
	1242	intertidal	162 lv + 6 sh
	1245	intertidal	95 lv + 13 sh
	1246	intertidal	5 lv
	1250	3-6 m	1 lv + 5 sh
	1253	2-3 m	70 lv
	1255	11 m	23 lv + 3 sh
	1256	15-20 m	1 lv
	1259	15-35 m	6 lv + 6 sh
	1260	49-59 m	16 lv + 4 sh
	1261	45-56 m	1 sh
	1264	8 m	75 lv + 9 sh
	1266	10-15 m	58 lv + 2 sh
	1269	15-20 m	5 lv + 3 sh
	1270	10-35 m	9 lv + 2 sh
	1271	5-25 m	52 lv + 2 sh
	1272	10 m	51 lv + 1 sh
	1273	20 m	9 lv
C. maestratii n. sp.	1271	5-25 m	1 sh
C. microstriatum n. sp.	1264	8 m	1 sh
C. modestum	1239	-	7 lv + 1 sh
	1240	0-2 m	22 lv + 17 sh
	1241	0-2 m	1 sh
	1242	-	68 lv + 23 sh
	1245	-	1 sh
	1250	3-6 m	1 sh
	1253	2-3 m	1 lv + 3 sh
	1259	15-35 m	1 lv
	1260	49-59 m	1 sh
	1261	45-56 m	1 sh
	1264	8 m	3 sh
	1267	2-4 m	1 lv
C. musorstomi n.sp.	1260	49-59 m	9 sh
	1261	45-56 m	2 sh
	1264	8 m	2 sh
	1266	10-15 m	1 sh
C. neocaledonicum	1237	0-1 m	1 sh
	1240	0-2 m	2 lv + 2 sh
	1242	-	5 lv + 2 sh
	1248	-	1 sh
	1253	2-3 m	1 sh
	1259	15-35 m	1 sh
	1260	49-59 m	1 sh
	1264	8 m	4 sh
C. sepimentum	1240	0-2 m	5 lv + 2 sh
	1245	-	1 sh
	1255	11 m	1 lv
	1259	15-35 m	1 sh
	1260	49-59 m	7 sh
	1261	45-56 m	1 sh
	1264	8 m	2 sh
	1266	10-15 m	1 sh
	1269	15-20 m	16 lv + 11 sh
	1270	10-35 m	7 lv + 2 sh
	1271	5-25 m	5 lv + 9 sh
	1272	10 m	1 lv + 8 sh
	1273	20 m	12 lv + 5 sh

C. smriglioi	1259	15-35 m	1 sh
C. succineum	1260 1264	49-59 m 8 m	1 sh 2 sh
C. vertebrale	1273	20 m	1 sh
M. kajiyamai	1240 1269 1271 1272 1273	0-2 m 15-20 m 5-25 m 10 m 20 m	67 lv + 1 sh 12 sh 5 sh 3 sh 2 sh
P. cf. *cornucopiae*	1260 1261	49-59 m 45-56 m	6 sh 2 sh
P. cf. *japonica*	1260 1261 1264	49-59 m 45-56 m 8 m	2 sh 1 sh 1 sh
P. pulcherrima n. sp.	1259 1260	15-35 m 49-59 m	2 sh 1 sh
Montrouzier Exp. '93 - New Caledonia, Koumac Sector NW			
C. clarum	1277 1279	0-2 m -	2 sh 1 sh
C. cf. *folini*	1277 1292 1310	0-2 m - 15 m	1 sh 5 sh 1 sh
C. inflatum	1277 1284 1292	0-2 m intertidal intertidal	1 sh 1 sh 1 sh
C. japonicum	1284 1289 1299 1310 1318	intertidal intertidal 12-14 m 15 m 20-30 m	1 sh 1 sh 11 lv 1 lv 3 lv (alc)
C. mauritianum	1277 1284 1292	0-2 m - -	2 sh 1 sh 1 lv + 1 sh
C. microstriatum n. sp.	1277	0-2 m	2 sh
C. modestum	1277 1278 1279 1280 1282 1284 1289 1291 1292 1298 1299 1300 1303	0-2 m 0-2 m intertidal - intertidal intertidal intertidal intertidal intertidal 2-4 m 12-14 m 10-11 m 0-8 m	248 lv + 65 sh 1 lv(alc) +109 sh 228 sh 1 sh 2 sh 22 lv + 20 sh 13 juv., 26 sh + 20 lv 14 juv, 19 lv + 7 sh 46 sh + 51 lv 4 sh 1 lv (juv) 3 lv (alc) + 48 sh 9 sh, 9 lv + 2 lv (alc)
	1307 1319 1331	12 m 15-20 m 55-57 m	1 lv 1 lv 1 sh (2 growth stages still attached)
C. musorstomi n.sp.	1277 1284 1289 1292 1299 1303 1331	0-2 m intertidal intertidal intertidal 12-14 m 0-8 m 55-57 m	1 sh 1 sh 1 lv + 1 sh 1 lv + 1 sh 2 lv + 2 sh 2 lv 1 sh
C. neocaledonicum	1279 1284 1291 1292 1298 1300 1303 1305	intertidal intertidal intertidal intertidal 2-4 m 10-11 m 0-8 m 12-15 m	8 lv, 3 sh, 1 juv. + 1 sf 8 lv (4 juv) + 16 sh (4 juv) 3 sh (2 juv) 1 lv (juv) + 2 sh 3 sh 1 lv (juv)+ 1 lv (alc) 10 lv 1 sh (juv)

C. sepimentum	1279 1284 1289 1292 1299 1300 1308 1310	intertidal - - - 12-14 m 10-11 m 15-20 m 15 m	2 lv + 1 sh 5 lv + 3 sh 1 sh (juv) 1 lv (juv) 1 lv (juv) 1 sh 3 lv (1 juv) + 1 sh 15 lv (juv) + 36 lv
	1312 1316 1318 1319 1331	26-40 m 12 m 20-30 m 15-20 m 55-57 m	55 lv (10 juv) + 2 sh +10 lv (alc) 36 lv (9 juv) 87 lv (35 juv) + 7 sh + 8 lv (alc) 28 lv (11 juv) + 5 sh +1 lv (alc) 13 lv + 37 sh
C. succineum	1310 1312	15 m 26-40 m	1 sh 2 lv
C. cf. *gulosum*	1277	0-2 m	1 sh
M. boucheti	1331	55-57 m	1 sh
M. kajiyamai	1331	55-57 m	5 sh
P. cf. *cornucopiae*	1298 1299	2-4 m 12-14 m	1 sh 1 sh
P. japonica	1284	-	1 sh
Norfolk 1, 2001 - New Caledonia S - Norfolk Ridge - Banc P			
C. bathus n. sp.	DW 1723	266-267 m	1 sh

Tab. 2.

species	station	depth range	live= lv; dead = sh; lar = larval shell
Atelier Lifou 2000 - Loyalty Islands, Lifou, Santal Bay			
C. amamieuse	1453 (in alcohol)	21-30 m	1 sh
C. cooki	1429 1434 1442 1450 1451 1454 1456 1457	8-18 m 5-20 m 47 m 27-31 m 10-21 m 15-18 m 25-30 m 5-10 m	1 sh 1 sh 1 sh 1 sh 1 sh 2 lv + 3 sh 1 sh 1 sh
C. cf. *foliui*	1412 1422 1429 1430 1456	2-5 m 4 m 8-18 m 20-25 m 25-30 m	1 lv (broken) 1 sh 1 sh (two stages still attached) 1 lv 1 lv
C. cf. *glabellum*	1412 1432	2-5 m 12-32 m	1 lv 1 lv
C. japonicum	1453 (in alcohol)	21-30 m	1 lv
C. koutiki	1462	70-120 m	1 sh
C. loyalteuse n. sp.	1442 1448	47 m 20 m	1 sh 1 sh
C. maestratii n. sp.	1410	2-4 m	1 sh
C. neocaledonicum	1406 1410 1412 1419 1420 1422 1423 1427	intertidal 2-4 m 2-5 m 5 m 4-5 m 4 m - 10 m	1 sh 1 sh 1 sh 1 sh (short form) 1 sh 1 sh 1 sh 1 sh

	1429	8-18 m	1 sh (juv.)
	1430	20-25 m	1 sh
	1450	27-31 m	1 sh
	1455	15-20 m	1 sh
	1456	25-30 m	1 sh
	1457	5-10 m	1 s lv + 1 sh
C. sepimentum	1406	intertidal	1 lv + 1 sh
	1410	2-4 m	8 lv + 4 sh
	1414	4-7 m	2 lv + 1 sh
	1415	3-7 m	1 lv
	1420	4-5 m	2 sh
	1421	4 m	4 lv + 4 sh
	1422	4 m	2 sh
	1423	-	1 lv + 24 sh
	1426	4-7 m	3 sh
	1427	10 m	2 sh
	1429	8-18 m	25 lv + 11 sh
	1430	20-25 m	11 sh
	1432	12-32 m	8 lv + 6 sh
	1434	5-20 m	4 lv + 49 sh
	1435	5-30 m	11 lv + 5 sh
	1436	10-20 m	1 lv + 4 sh
	1442	47 m	1 lv + 7 sh
	1444	9-20 m	9 sh
	1448	20 m	2 sh
	1449	17 m	27 lv + 9 sh
	1450	27-31 m	47 lv + 18 sh + 4 lv (alc)
	1451	10-21 m	4 lv + 48 sh + 3 lv (alc)
	1453	21-30 m	25 lv + 8 sh + 3 lv (alc)
	1454	15-18 m	148 lv + 12 lv (alc) + 3 sh + + 2 prot. (lv)
	1455	15-20 m	8 lv + 6 sh
	1456	25-30 m	16 lv and 10 sh
	1457	5-10 m	119 lv + 11 sh + 6 lv (alc)
	1459	55-80 m	2 lv + 4 sh
	1462	70-120 m	1 sh
C. succineum	1450	27-31 m	1 sh
	1455	15-20 m	1 sh
C. vertebrale	1412	2-5 m	1 sh
	1423	-	1 sh
	1429	8-18 m	2 sh
	1432	12-32 m	1 sh
	1434	5-20 m	1 lv + 2 sh
	1436	10-20 m	1 sh
	1442	47 m	2 sh (1 juv)
	1444	9-20 m	1 sh
	1448	20 m	3 sh
	1449	17 m	1 sh
	1450	27-31 m	1 sh
	1454	15-18 m	1 lv + 2 sh
	1457	5-10 m	2 lv + 1 lv (alc) + 3 sh
M. rhinoceros n. sp.	1456	25-30 m	2 sh
S. kilburni n. sp.	1449	17 m	1 sh
S. hinemoa	1449	17 m	1 prot. (sh)

Tab. 3.

species	station	depth range	live= lv; dead = sh; lar = larval shell
Musorstom 10, 1998 - Fiji Islands, N/O "Alis"			
C. amamiense	DW 1381	275-430 m	1 sh
	CP 1354	959-963 m	2 sh
	CP 1366	149-168 m	1 sh
	CP 1369	392-433 m	20 sh
C. cf. *campanulatum*	DW 1381	275-430 m	1sh

C. chinense	CP 1354	959-963 m	1sh
C. cooki	DW 1381	275-430 m	5 sh
C. sp. *B*	DW 1381 CP 1369	275-430 m 392-433 m	3 sh 1 sh juv.
C. dakuwaqa n. sp.	DW 1314 DW 1333 DW 1334 DW 1365 DW 1376 DW 1381 DW 1384 CP 1354 CP 1363 CP 1366 CP 1369	656-660 m 200-215 m 251-257 m 295-302 m 497-504 m 275-430 m 260-305 m 959-963 m 144-150 m 149-168 m 392-433 m	2 sh 8 sh 2 sh 3 sh 1 sh 2 sh 2 sh 2 sh 4 sh 9 sh 14 sh
C. fijiense	DW 1333 DW 1376 DW 1381 DW 1384	200-215 m 497-504 m 275-430 m 260-305 m	3 lv + 29 sh 4 sh 1 sh 1 sh
C. cf. *folini*	DW 1314 DW 1381	656-660 m 275-430 m	1 sh 1 sh
C. cf. *glabellum*	CP 1353	879-897	1 sh
C. inflatum	CP 1354 DW 1381	959-963 275-430	2 sh 2 sh
C. japonicum	DW 1333 DW 1381	200-215 275-430	1 lv 1 sh
C. lapita n. sp.	CP 1366	149-168 m	1 sh
C. maestratii n. sp.	DW 1381	275-430	4 sh
C. musorstomi n. sp.	CP 1366	149-168	1 sh
C. neocaledonicum	DW 1333 DW 1381 DW 1384 CP 1325 CP 1363 CP 1366 CP 1369	200-215 275-430 260-305 282-322 144-150 149-168 392-433	1 sh 5 sh 2 sh 1 sh 1 sh 1 sh 1 sh
C. sepimentum	DW 1314 DW 1333 DW 1345 DW 1376 DW 1381 DW 1384 CP 1353 CP 1366	656-660 200-215 660-663 497-504 275-430 260-305 879-897 149-168	8 sh 5 sh 1 sh 3 sh 1 lv + 50 sh 2 sh 2 sh 2 sh
C. succineum	DW 1314	656-660	1 sh
C. vertebrale	DW 1333 DW 1381 DW 1384 CP 1354	200-215 m 275-430 m 260-305 m 959-963 m	1 sh 4 sh 1 sh 2 sh
C. virginiae n. sp.	DW 1381	275-430 m	2 sh
C. sp. *A*	CP 1369	392-433 m	1 sh (broken
M. boucheti	DW 1381	275-430 m	1 sh

M. kajiyamai	DW 1381	275-430 m	2 sh
M. legumen	DW 1381	275-430 m	3 sh
P. cf. *japonica*	DW 1333 DW 1334 DW 1381 DW 1384 CP 1363 CP 1366 CP 1369	200-215 m 251-257 m 275-430 m 260-305 m 144-150 m 149-168 m 149-168 m	1 sh (quite smooth) 1 sh 4 sh 1 sh 1 sh 1 sh 1 sh
P. megadattilida n. sp.	DW 1333 DW 1334 DW 1381	200-215 m 251-257 m 275-430 m	1 sh 2 sh 1 sh
P. melanesiana n.sp.	DW 1333 DW 1376 DW 1381 DW 1384 CP 1354 CP 1363 CP 1366 CP 1369	200-215 m 497-504 m 275-430 m 260-305 m 959-963 m 144-150 m 149-168 m 392-433 m	6 sh 2 sh 19 sh 4 sh 1 sh 1 sh 6 sh 2 sh
Bordau 1, Feb. - Mar. 1999 - Fiji Islands, N/O "Alis"			
C. bathus n. sp.	DW 1469	-	3 sh

Tab. 4.

species	station	depth range	live= lv; dead = sh; lar = larval shell
Musorstom 8, 1994 - Vanuatu Islands			
C. dakuwaqa n. sp.	DW 1072 DW 1105	622-625 m 154-179 m	1 sh 15 sh
C. glabellum	CP 1131-1132	140-182 m	1 sh
C. japonicum	DW 1072	622-625 m	1 sh
C. sepimentum	DW 1105 CP 1131-1132	154-179 m 140-182 m	1 sh 12 sh
C. subcylindratum n. sp.	DW 1065	360-419 m	1 sh
C. amamiense	FB 83	8-20 m	1 sh
C. chinense	DB 69 ET 14 LD 29	38 m 23-24 m 10-12 m	1 sh 1 lv 29 sh
C. cooki	DB 20	22-25 m	1 sh
C. inflatum	LD 29	10-12 m	1 sh
C. japonicum	DB 08 DB 12 DB 14 DB 16 DB 20 DB 25 DB 29 DB 33 DB 40 DB 46 DB 53 DB 58 DB 63 DB 65 DB 67	12 m 10-18 m 10-14 m 32-40 m 22-25 m 10 m 15 m 14-25 m 5 m 2-3 m 5 m 6-43 m 21 m 13 m 7 m	47 lv + 1 sh 400 lv ca. 36 lv + 1 sh 7 lv + 2 sh 7 lv + 13 sh 3 lv + 3 sh 240 lv + 16 sh 11 lv + 2 sh 32 lv 3 lv + 2 sh 161 lv + 8 sh 8 sh 9 lv + 2 sh 13 lv + 1 sh 10 lv

	DB 71	7 m	8 lv
	DB 75	20 m	3 sh
	DB 77	42-45 m	1 lv
	DB 80	18 m	92 lv
	DB 83	6 m	13 lv
	DB 86	13 m	44 lv
	DS 04	25 m	3 sh
	DS 10	6-24 m	1 sh
	DS 43	22 m	5 sh
	DS 49	10-17 m	5 lv
	DS 54	5 m	2 lv
	DS 91	7 m	2 sh
	DS 103	70-80 m	1 lv + 9 sh
	DS 105	92 m	1 sh
	ED 17	23-27 m	1 lv
	EP 01	46-47 m	2 lv + 2 sh
	EP 28	90-110 m	1 lv
	EP 34	40-80 m	22 lv
	EP 36	20-60 m	40 lv
	EP 37	50-61 m	1 lv
	EP 39	75-80 m	4 lv + 1 sh
	FB 40	9 m	20 lv + 1 sh
	FB 52	7 m	39 lv + 2 sh
	FB 56	3-18 m	12 lv
	FB 61	2-3 m	2 lv
	FB 64	11 m	44 lv + 1 sh
	FB 68	16 m	32 lv + 1 sh
	FB 72	2 m	7 lv
	FB 80	36-39 m	160 lv
	FB 90	2-4 m	1 lv
	FB 92	45-50 m	23 lv
	FP 46-49	20-31 m	5 lv +1 sh
	FS 54	10-12 m	2 lv
	LD 29	7 m	21 sh
	LS 17	20 m	2 lv + 1 sh
	NB 12	6-30 m	26 lv
	NB 43	2-3 m	1 lv
	NS 36	2-3 m	1 sh
	NS 37	5-7 m	11 sh
	ZB 09	5 m ca.	134 lv
	ZB 16	26 m	42 lv + 1 sh
	ZB 24	intertidal	1 lv
	ZM 15		61 lv + 2 sh
C. kontiki	DS 99	100-105 m	1 sh
C. loyaltense n. sp.	FS 77	29 m	1 sh
C. maestratii n. sp.	DB 20	22-25 m	1 sh
	DB 61	41 m	1 sh
	FB 64	-	1 sh
C. modestum	DB 08	12 m	1 sh
	DB 40	5 m	2 lv + 4 sh
	DB 46	2-3 m	3 lv + 1 sh
	DB 53	5 m	61 lv + 11 sh
	DS 54	5 m	1 lv + 1 sh
	ED 02	18-21 m	1 sh
	FB 40	9 m	4 lv
	FB 61	2-3 m	1 sh
	FB 80	2 m	2 lv + 2 sh
	LD 09	2-3 m	10 lv + 38 sh
	LD 29	10-12 m	6 sh

	LD 30	7-8 m	1 sh
	LS 2	3 m	1 sh
	NS 37	2-3 m	1 lv + 1 sh
	ZM 15	intertidal	32 lv
	VM 59	intertidal	1 lv
C. musorstomi n. sp.	DB 08	12 m	1 sh
	DB 12	10-18 m	8 lv + 13 sh
	DB 14	10-14 m	1 lv + 2 sh
	DB 20	22-25 m	1 sh
	DB 40	5 m	2 sh
	DB 53	5 m	9 lv + 7 sh
	DB 69	38 m	3 sh
	DS 43	22 m	3 sh
	DS 54	5 m	2 sh
	FB 40	9 m	1 sh
	FB 52	7 m	5 lv + 2 sh
	FB 61	2-3 m	1 sh
	FB 92	2-4 m	1 sh
	LD 09	2-3 m	1 sh
	LD 29	10-12 m	1 sh
	LS 17	7 m	2 sh
	NB 12	20 m	1 lv
	NS 36	2-3 m	1 sh
	NS 37	2-3 m	1 sh
	ZB 16	5 m ca.	2 sh
C. neocaledonicum	DB 20	22-25 m	1 lv + 1 sh
	DB 53	5 m	1 lv + 1 sh
	DB 69	38 m	2 sh
	DB 75	20 m	1 sh
	FB 40	9 m	1 sh
	FB 90	36-39 m	1 sh
	LD 29	10-12 m	1 sh
	ZB 16	5 m ca.	1 lv
	VM 46	-	1 lv
C. sepimentum	DB 08	12 m	13 lv + 11 sh
	DB 12	10-18 m	45 lv + 16 sh
	DB 14	10-14 m	1 lv + 1 sh
	DB 16	32-40 m	28 lv + 11 sh
	DB 20	22-25 m	32 lv + 39 2 lv + 6 sh
	DB 25	10 m	10 lv + 2 sh
	DB 29	15 m	3 sh
	DB 33	14-25 m	2 sh
	DB 40	5 m	1 sh
	DB 46	2-3 m	4 lv + 6 sh
	DB 53	5 m	5 lv + 9 sh
	DB 58	6-43 m	7 lv + 1 sh
	DB 61	41 m	7 lv + 1 sh
	DB 63	21 m	1 lv + 3 sh
	DB 65	13 m	2 lv + 7 sh
	DB 67	7 m	11 lv + 20 sh
	DB 69	38 m	11 lv
	DB 71	7 m	2 lv
	DB 75	20 m	10 lv + 7 sh
	DB 77	42-45 m	11 lv
	DB 80	18 m	8 lv
	DB 83	6 m	10 sh
	DB 86	13 m	7 sh
	DS 10	6-24 m	1 lv + 4 sh
	DS 43	22 m	3 sh

	DS 49	10-17 m	3 lv + 2 sh
	DS 93	70 m	4 lv + 11 sh
	DS 96	114 m	7 lv + 2 sh
	DS 99	100-105 m	8 lv + 6 sh
	DS 102	98-100 m	3 lv and 11 sh
	DS 105	92 m	1 sh juv.
	DS 108	100 m	9 lv
	ED 11	23-33 m	42 lv + 14 sh
	EP 01	46-47 m	13 lv + 1 sh
	EP 10	45-101 m	1 sh
	EP 19	80-94 m	4 sh
	EP 21	99 m	9 lv + 34 sh
	EP 22	78-91 m	1 sh
	EP 24	108-121 m	6 sh
	EP 28	90-110 m	1 lv
	EP 32	100 m	15 lv + 1 sh
	EP 34	40-80 m	4 lv
	EP 35	10-51 m	17 lv
	EP 36	20-60 m	6 lv
	EP 37	50-61 m	2 lv
	EP 38	90-93 m	109 lv + 3 sh
	EP 39	75-80 m	20 lv + 1 sh
	FB 40	9 m	38 lv
	FB 43	19 m	3 lv + 12 sh
	FB 52	7 m	7 lv
	FB 56	3-18 m	2 sh
	FB 61	2-3 m	8 lv + 5 sh
	FB 64	-	4 lv
	FB 68	11 m	1 lv + 16 sh
	FB 72	16 m	2 sh
	FB 80	2 m	1 lv + 15 sh
	FB 83	8-20 m	63 lv + 6 sh
	FB 90	36-39 m	4 sh
	FB 92	2-4 m	42 lv
	FP 46-49	45-50 m	1 sh
	FS 54	20-31 m	2 sh
	FS 77	29 m	
P. cf. *cornucopiae*	FB 61	2-3 m	1 s
P. cf. *japonica*	DB 12	10-18 m	cf. *japonica* 1 sh
	DB 40	5 m	1 sh
	DB 69	38 m	2 sh
	DB 77	42-45 m	1 sh
	DS 18	5-10 m	1 sh
	DS 93	70 m	1 sh
	DS 105	92 m	1 sh
	NB 12	20 m	1 lv
	NS 37	2-3 m	2 sh
	ZB 06	30 m	30 m
P. vanuatuensis	FS 74	12 m	1 sh

Tab. 5.

species	station	depth range	live= lv; dead = sh; lar = larval shell
Musorstom 7, 1992 - Wallis Is., SW Pacific - N/O "Alis"			
C. uvea n. sp.	DW 605	335-340 m	1 sh

Tab. 6.

species	station	depth range	live= lv; dead = sh; lar = larval shell
Musorstom 3, 1985 - Philippines Islands, N/O "Coriolis"			
C. sepimentum	DR 137	56 m	2 sh

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Appendix I

List of the species

Caecum amamiense (Habe, 1978) - p. 17, Fig. 10E
Caecum bathus n. sp. - p. 31, Fig. 13E
Caecum cf. *campanulatum* Raines & Pizzini, 2005 - p. 21, Fig. 11B
Caecum chinense Folin, 1868 - pp. 29, 30, Fig. 12K-N
Caecum clarum Lamy (MS Folin), 1909- pp. 9, 11, Fig. 8N, O, Q
Caecum cooki Pizzini & Raines, 2011 - pp. 35, 37, Figs 14H-J, 19J
Caecum dakuwaqa n. sp. - pp. 19, 20, Fig. 10K-O
Caecum fijiense n. sp. - pp. 20, 21, Figs 10P-R, 19A
Caecum kontiki Pizzini & Raines, 2011 - p. 24, Fig. 11L, M
Caecum cf. *folini* Kish, 1959 - pp. 21, 23, Figs 11C, D, 19B
Caecum cf. *glabellum* (Carpenter *in* Adams, 1868) - pp. 24, 25, Figs 11N-P, 19C
Caecum gulosum Hedley, 1899 - p. 23, Fig. 11H-J
Caecum inflatum Folin, 1869 - pp. 30, 31, Fig. 12O-R
Caecum japonicum (Habe, 1978) - pp. 26, 27, Figs 12D-F, 19D, 20F-H, J
Caecum lapita n. sp. - pp. 16, 17, Fig. 10A-D
Caecum loyaltense n. sp. - pp. 23, 24, Fig. 11K
Caecum maestratii n. sp. - pp. 17, 19, Fig. 10F-J
Caecum mauritianum Folin, 1868 - pp. 33, 34, Fig. 13I-K
Caecum microstriatum n. sp. - p. 34, Fig. 13L-Q
Caecum modestum Folin, 1868 - pp. 34, 35, Figs 14C-F, 19E, 20L-M
Caecum musorstomi n. sp. - pp. 27, 29, Figs 12G-I, 19F
Caecum neocaledonicum Folin, 1868 - pp. 13, 15, Figs 9G-K, 19H, 20I, K
Caecum sepimentum Folin, 1868 - pp. 5-8, Figs 8A-D, 8F-G, 19K, 20A-E
Caecum smriglioi Pizzini, Nofroni & Bonfitto, 2008 - pp. 11, 13, Fig. 9D-F
Caecum subcylindratum n. sp. - pp. 31, 33, Fig. 13F-H
Caecum succineum Folin, 1880 - pp. 25-26, Figs 11Q, R, 12A-C, 19I
Caecum uvea n. sp. - p. 37, Fig. 14N-Q
Caecum vanuatuarum n. sp. - pp. 37, 39, Fig. 15A-C
Caecum varanoi Pizzini, Nofroni & Bonfitto, 2008 - p. 11, Fig. 9A-C
Caecum vertebrale Hedley, 1899 - pp. 8-9, Figs 8I, 8K-M, 19G
Caecum virginiae n. sp. - p. 16, Fig. 9L-N
Caecum sp. *A* - p. 39, Fig. 15D
Caecum sp. *B* - pp. 39, 40, Fig. 14A
Meioceras boucheti Pizzini & Raines, 2011 - pp. 40, 41, Fig. 15I, J
Meioceras kajiyamai Habe, 1963 - pp. 41, 42, Fig. 15L, M
Meioceras legumen (Hedley, 1899) - p. 40, Fig. 15E, 15H
Meioceras rhinoceros n. sp. - p. 42, Fig. 16A-C
Parastrophia cf. *cornucopiae* (Folin, 1869) - p. 43, Fig. 16D-G
Parastrophia cf. *japonica* Hinoide & Habe, 1978 - pp. 45, 46, Fig. 16P-S
Parastrophia megadattilida n. sp. - pp. 47, 49, Figg. 17F-J, 19L, 20O
Parastrophia melanesiana n. sp. - pp. 43, 45, Fig. 16J-L
Parastrophia pulcherrima n. sp. - pp. 46, 47, Fig. 17A-E
Parastrophia vanuatensis n. sp. - p. 49, Fig. 18E-G
Strebloceras hinemoa Finlay, 1931- p. 53, Fig. 18L, 18P
Strebloceras kilburni n. sp. - pp. 51, 53, Fig. 18H-K

Appendix II

Oceanographic Expeditions, stations and species. Live collected specimens are marked with an asterisk.

Expédition Vauban 1976 - S New Caledonia, 1 station, 4 species, depth range 250-350 m (Tab. 1).
Stn 40, 22° 30'S, 166° 24'E, 250-350 m; *C. amamiense*, *C. vertebrale*, *C. sepimentum*, *M. legumen*.

Expédition Vauban 1978/79 - S New Caledonia, 1 station, 1 species, depth range 425-430 m (Tab. 2).
Stn 2, 22° 17'S, 167° 14'E, 425-430 m; *C. sepimentum*, *C. vertebrale*.

Orstom1987- New Caledonia, Canala Sector, Ecoast, 1 station, 1 species, depth 35 m (Tab. 3).
Stn 748, 21°17'S, 165°50'E, 35 m, Bouchet & Richer, ORSTOM coll. 06/01/1987; *C. sepimentum*.

Musorstom 3, 1985 - Philippine Islands, N/O "Coriolis", 1 station out of 59, 1 sp. Depth 56 m (Tab. 4).
Stn DR 137, 12°03'N, 122°06'E, 56 m, Bouchet & Triclot leg. 06/06/1985; *C. sepimentum*.

Musorstom 7, 1992 - Wallis Is., S W Pacific - N/O "Alis" - 1 station out of 142, 1 n. sp. Depth range 335-340 m. (Tab. 5)
Stn DW 605, 13°21'S, 176°08'W, 335-340 m, Bouchet/Metivier/Richer leg. 26/05/1992; *C. uvea* n. sp.

Campagne Lagon, 1992 - New Caledonia, Nouméa Sector SW - 5 Stations (Tab. 6)
Stn 1351, Mâitre islet, reef flat, 22°20.4'S, 166°25.7'E, high tide line, Bouchet & Marshall leg. 25/11/1992; *C. modestum**, *C. japonicum**, *C. neocaledonicum**, *C. sepimentum**, *C. musorstomi* n. sp.*.
Stn 1352, Noumea Lagoon, Grand Reef Aboré, 22°22.2'S, 166°16.0'/166°16.1'E, outer slope, 27-35 m, Bouchet & Marshall leg. 27-30/11/1992; no Caecidae.
Stn 1352, (in alcohol), Noumea Lagoon, Grand Reef Aboré, 22°22.26'S, 166°15.92'E, outer slope, 12-37 m, Bouchet & Marshall leg. 30/11/1992; *C. sepimentum** "National Museum of New Zealand - Caecidae".
Stn 1355, Pointe Magnin, 22°18.9'S, 166°26.6'E, Canyon rim, blocks, sediment, 7-10 m, Bouchet & Marshall leg. 03/12/1992; *C. japonicum**, *C. musorstomi* n. sp.
Stn 1367, Goéland islet, 22°24.3'S, 166°20.7'E, *Sargassum* on white backgrounds, 10 m, P. Bouchet leg. 16/04/1993; *C. japonicum**, *C.* cf. *musorstomi* n. sp.
Stn 1371, Récif Larégnère, 12-16 m, 22°19.9'S, 166°17.6'/166°16.1'E, inner slope, P. Bouchet leg. 03/5/1992; *C. japonicum**, *C. succineum* (anomalous specimen), *C. sepimentum**, *C. musorstomi* n. sp.*.

Smib 8, Jan. - Feb. 1993 - S New Caledonia, N/O "Alis", banc Eponge (Mont B), 1 Station out of 57, 1 sp. Depth 510 m. (Tab. 7)
Stn DW 148, 24°56'S, 168°21'E, 510 m, Bouchet & Richer leg. 27/01/1993; *C. bathus* n. sp.

Bathus 1, 1993 - New Caledonia: East coast - N/O "Alis" - 4 Stations out of 74, 8 species, of which 2 n. sp. Depth range 45-400 m. (Tab. 8)
Stn DW 654, 21°17'S, 166°57'E, 237-298 m, Bouchet & Richer, ORSTOM leg. 14/03/1993; *C.* cf. *mauritianum*.
Stn DW 674, 20°49'S, 165°19'E, 105-110 m, Bouchet & Richer, ORSTOM leg. 14/03/1993; *Parastrophia* cf. *japonica*, *Parastrophia* cf. *cornucopiae*.
Stn DW 683, 20°35'S, 165°07'E, 380-400 m, Bouchet & Richer, ORSTOM leg. 14/03/1993; *C. sepimentum*.
Stn DW 1233, 22°23.5'S, 166°47.6'E, Canal Woodin, 45-50 m, Bouchet & Richer, ORSTOM leg. 09/03/1993; *C. japonicum**, *C. musorstomi* n. sp.*, *C. sepimentum*, *C. gulosum*, *Parastrophia vanuatensis* n. sp.

Bathus 2, 1993 - N/O "Alis" - SW New Caledonia - 1 Station out of 57, 1 sp. Depth 495 m. (Tab. 9)
Stn CP 755, 22°22'S, 166°14'E, 495 m, Bouchet & Richer, ORSTOM leg. 16/05/1993; *C.* cf. *glabellum*.

Bathus 3, Nov. - Dec. 1993 - New Caledonia, Norfolk Ridge - N/O "Alis" - 3 Stations out of 78, 3 sp. of which 1 new sp. Depth range 381-760 m. (Tab. 10)
Stn DW 778, Loyalty Ridge, 24°43'S, 170°07'E, 750-760 m, Bouchet, Richer & Warén leg. 24/11/1993; *C. bathus* n. sp.
Stn DW 809, Norfolk Ridge, 23°39'S, 167°59'E, 650-730 m, Bouchet, Richer & Warén leg. 27/11/1993; *C. bathus* n. sp.
Stn DW 827, Norfolk Ridge, 23°22'S, 168°01'E, 381-469 m, Bouchet, Richer & Warén leg. 29/11/1993; *C. bathus* n. sp.
Exp. Montrouzier Sept. '93 - New Caledonia, Touho Sector East coast - 23 Stations, 18 sp. of which 4 n. sp. Depth range 0-59 m. (Tab. 11)
Stn 1237, Touho Bay, 20°46.9'S, 165°13.8'E, sandy and sheltered seagrass, 0-1 m; *C. neocaledonicum*.
Stn 1239, between Pointe Kombounou and Koé, 20°47.2'S, 165°14.6'E, mangrove; *C. modestum**, *C. japonicum**.
Stn 1240, between Touho Bay and Atit islet, 20°4.5'S, 165°14' - 165°15'E, sheltered reef, sand, seagrass, 0-2 m; *C. modestum**, *C. japonicum**, *C. neocaledonicum**, *C. sepimentum**, *C. clarum*, *M. kajiyamai**.
Stn 1241, between l'aérodrome and Koé, 20°48'S, 165°15.7'E, battered reef flat, 0-2 m; *C. modestum*.
Stn 1242, Reef flat off Touho wharf, 20°46.2'S, 165°14.5'E, tide line, blocks, sand, seagrass; *C. modestum**, *C. japonicum**, *C. neocaledonicum**.
Stn 1245, Grand Récif Mengalia, 20°45.2'S, 165°16.3'E, tidal reef flat, blocks, sand, seagrass; *C. modestum*, *C. japonicum**, *C. sepimentum*.
Stn 1246, Ouao islet (=I. Camille), 20°42.8'S, 165°08.7'E, tidal reef flat, blocks, sand, seagrass; *C. japonicum**.
Stn 1248, Tiwaka Estuary, 20°52.3'S, 165°16.0'E, tidal reef flat mixture, littoral zone; *C. neocaledonicum**.

Stn 1250, Touho Bay, 20°46.7'S, 165°13.7'E, 3-6 m, sandy mud; *C. modestum*, *C. japonicum**.

Stn 1253, Kombounou Point, 20°46.6'S, 165°14.1'E, 2-3 m, photophilic algae, silt; *C. modestum**, *C. japonicum**, *C. neocaledonicum**.

Stn 1255, outskirts of Ouao islet (= I. Camille), 20°43'S, 165°08'E, 11 m, sand, detrital mounds; *C. japonicum**, *C. sepimentum**.

Stn 1256, Viex-Touho Lagoon entrance, 20°45.0'S, 165°09.8'E, 15-20 m, live coral, mud; *C. japonicum**.

Stn 1259, Touho Bench, 20°44.6'S, 165°13.7'E, 15-35 m, outfalls with silt; *C. smriglioi*, *C. modestum**, *C. neocaledonicum*, *C. japonicum**, *C. sepimentum*, *Parastrophia pulcherrima* n. sp.

Stn 1260, Channel NE of Touho Bench, 20°44'S, 165°14'E, 49-59 m, shell grit; *C. modestum*, *C.* cf. *folini*, *C. neocaledonicum*, *C. japonicum**, *C.* cf. *cooki*, *C. succineum*, *C. sepimentum*, *C. musorstomi* n. sp., *Parastrophia* cf. *japonica*, *Parastrophia* cf. *cornucopiae*, *Parastrophia pulcherrima* n. sp.

Stn 1261, Touho Channel, 20°46'S, 165°15' - 165°16.5'E, 45-56 m, detrital sand; *C. modestum*, *C. japonicum*, *C. sepimentum*, *C. musorstomi* n. sp.*, *Parastrophia* cf. *japonica*, *Parastrophia* cf. *cornucopiae*.

Stn 1264, Grand Récif Mengalia Lagoon, 20°44.5'S, 165°15.9'E, 8 m, sandy mud, detrital mound; *C. modestum*, *C. japonicum**, *C. neocaledonicum**, *C. microstriatum* n. sp., *C. musorstomi* n. sp., *C. succineum*, *C. sepimentum*, *Parastrophia* cf. *japonica*, *C. gulosum*.

Stn 1266, Grand Récif Mengalia Lagoon, 20°39.6'S, 165°14.7'E, 10-15 m, reef patch; *C. japonicum**, *C. sepimentum*, *C. musorstomi* n. sp.*.

Stn 1267, Tiouandé Cove, 20°43.4'S, 165°02.0'E, 2-4 m, sandy; *C. modestum**.

Stn 1269, Récif Doiman, 20°35.1'S, 165°08.1'E, 15-20 m, outer slope; *C. japonicum**, *C. sepimentum**, *M. kajiyamai*, *C. amamiense*.

Stn 1270, Grand Récif de Mengalia, 20°45'S, 165°16.5'E; outer slope, 10-35 m; *C. japonicum**, *C. sepimentum**.

Stn 1271, Haut-Fond de Tié, 20°52.7'S, 165°19.5'E, 5-25 m, outfalls, slab in sand; *C. maestratii* n. sp., *C. amamiense*, *C. japonicum**, *C. sepimentum**, *M. kajiyamai*.

Stn 1272, Sand Isle, Touho Passage, 20°49.5'S, 165°19.6'E, hard bottom with silt, 10 m; *C. amamiense*, *C. japonicum**, *C. sepimentum**, *M. kajiyamai*.

Stn 1273, Outer reef, Touho Passage, 20°50.4'S, 165°22.8'E, hard bottom with patches of sandy mud and silt, 20 m; *C. japonicum**, *C. vertebrale*, *C. sepimentum**, *M. kajiyamai***.

Exp. Montrouzier Oct. '93 - New Caledonia, Koumac Sector NW - 22 Stations out of 142, 16 sp. (3 new sp.). Depth range 0-57 m. (Tab. 12)

Stn 1277, Koumac Cove (= Ouanap Bay), 20°34'S, 164°16'E, 0-2 m, soft bottom, seagrass; *C. modestum**, *C.* cf. *folini*, *C. mauritianum*, *C. microstriatum* n. sp., *C.* cf. *inflatum*, *C. clarum*, *C. musorstomi* n. sp, *C. gulosum*.

Stn 1278, Koumac Cove (= Ouanap Bay), 20°34'S, 164°16'E, hard bottom, 0-2 m; *C. modestum**.

Stn 1279, Pointe de Pandop, 20°35'S, 164°15.5'E, tide line, hard bottom, seagrass; *C. modestum**, *C. neocaledonicum**, *C. sepimentum**, *C. clarum*.

Stn 1280, Embouchure de la Koumac, 20°34'S, 164°15.8'E, mangrove; *C. modestum*.

Stn 1282, Tangadiou islet, 20°33.5'S, 164°13'E, island tidal reef flat, mixed bottoms; *C. modestum**.

Stn 1284, Rat islet (= I. de la Table), 20°33.7'S, 164°11'E, tide line, various bottoms; *C. modestum**, *C.* cf. *inflatum*, *C. japonicum*, *C. musorstomi* n. sp., *C. neocaledonicum**, *C. mauritianum*, *C. sepimentum**, *Parastrophia* cf. *japonica*.

Stn 1289, Paagoumène, 20°29.2'S, 164°10.2'E, tidal reef flat with blocks; *C. modestum**, *C. japonicum*, *C. sepimentum*, *C. musorstomi* n. sp.*.

Stn 1291, Pointe de Babouillat, 20°22.4'S, 164°06.8'E, tide line, rocky coastlines; *C. modestum**, *C. neocaledonicum*.

Stn 1292, Pointe de Babouillat, 20°22.4'S, 164°06.8'E, tidal soft bottoms; *C. modestum**, *C.* cf. *inflatum*, *C. neocaledonicum**, *C. mauritianum**, *C. sepimentum*, *C. musorstomi* n. sp.*, *C.* cf. *folini*.

Stn 1298, Pointe de Pandop, 20°35.2'S, 164°16.6'E, hard bottom, 2-4 m; *C. modestum*, *C. neocaledonicum**, *Parastrophia* cf. *cornucopiae*.

Stn 1299, Lagoon between the shore and l'Infernet, 20°34.4'S, 164°13.0'E, slab of gorgonians, silt, 12-14 m; *C. modestum**, *C. japonicum**, *C. sepimentum**, *C. musorstomi* n. sp.*, *Parastrophia* cf. *cornucopiae*.

Stn 1300, Lagoon between the shore and l'Infernet, 20°35.6'S, 164°15.2'E, gray muddy sand, 10-11 m; *C. modestum**, *C. neocaledonicum**, *C. sepimentum*.

Stn 1303, Lagoon near Plateau Karembé, 20°37.7' - 20°38.8'S, 164°11.2'E - 164°15.9'E, 164°17.1'E, muddy sand, blocks, 0-8 m; *C. modestum**, *C. neocaledonicum**, *C. musorstomi* n. sp.*.

Stn 1305, Infernet Channel, 20°36.2'S, 164°11.0'E, gray sand, 12-15 m; *C. neocaledonicum*.

Stn 1307, Baron Passage: Lagoon, 20°33.7'S, 164°10.3'E, *Heteropsammia* sand, 12 m; *C. modestum**.

Stn 1308, Kendec Lagoon islet, outfall, 20°40'S, 164°15.2'E, slab, 15-20 m; *C. sepimentum**.

Stn 1310, Koumac Passage, north outfall, 20°39.7'S, 164°14.9'E, 15 m, hard bottom; *C.* cf. *folini*, *C. japonicum**, *C. succineum*, *C. sepimentum**.

Stn 1312, Koumac Passage, east outfall, 20°40.4'S, 164°14.9'E, hard bottomdredge, 26-40 m; *C. succineum**, *C. sepimentum**.

Stn 1316, Grand Récif de Koumac, 20°40'S, 164°11.2'E, outer slope, 12 m; *C. sepimentum**.

Stn 1318, Grand Récif de Koumac, 20°41.4'S, 164°14.8'E, 20-30 m, outer slope; *C. japonicum**, *C. sepimentum**.
Stn 1319, Deverd Passage, 20°44.7'S, 164°15.5'E, slab, 15-20 m; *C. modestum**, *C. sepimentum**.
Stn 1331, Grand Récif de Koumac, 20°40.6'S, 164°11.2'-164°12.1'E, outer slope, 55-57 m; *C. modestum*, *C. sepimentum**, *M. kajiyamai*, *M. boucheti*, *C. musorstomi* n. sp.

Musorstom 8, 1994 - Vanuatu Islands - N/O "Alis" - 4 Stations out of 196, 5 sp. of which 2 new sp. Depth range 140-625 m. (Tab. 13)

Stn DW 1065, 16°16'S, 167°21'E, 360-419 m, Bouchet & Richer de Forges leg. 02/10/1994; *C. subcylindratum* n. sp.
Stn DW 1072, 15°40'S, 167°20'E, 622-625 m, Bouchet & Richer de Forges leg. 04/10/1994; *C. dakuwaqa* n. sp., *C. japonicum*.
Stn DW 1105, 15°03'S, 167°07'E, 154-179 m, Bouchet & Richer de Forges leg. 07/10/1994; *C. dakuwaqa* n. sp., *C. sepimentum*.
Stns CP 1131-1132, 15°38'S, 167°03'/167°04'E, 140-182 m, Bouchet & Richer de Forges leg. 11/10/1994; *C.* cf. *glabellum*, *C. sepimentum*.

Musorstom 10, 1998 - Fiji Islands, N/O "Alis" - 15 Stations out of 82, 4 sp. with soft parts out of a whole 26 sp. Depth range 144-963 m. (Tab. 14)

Stn DW 1314, Bligh Water, 17°16.1'S, 178°14.8'E, 656-660 m, Bouchet, Richer - ORSTOM coll. 05/08/98; *C. dakuwaqa* n. sp., *C.* cf. *folini*, *C. sepimentum*, *C. succinenm*.
Stn DW 1333, Bligh Water, 16°50.4'S, 178°12.5'E, 200-215 m, Bouchet, Richer - ORSTOM leg. 08/08/'98; *C. fijiense* n. sp.*, *C. dakuwaqa* n. sp., *C. neocaledonicum*, *C. japonicum**, *C. sepimentum*, *Parastrophia megadattilida* n. sp., *Parastrophia* cf. *japonica*, *Parastrophia melanesiana* n. sp., *C. vertebrale* (coated for SEM photos, never made).
Stn DW 1334, Bligh Water, 16°51.4'S, 178°13.9'E, 251-257 m, Bouchet, Richer - ORSTOM coll - 08/09/98; *C. dakuwaqa* n. sp., *Parastrophia megadattilida* n. sp., *Parastrophia* cf. *japonica*.
Stn DW 1345, Bligh Water, 660-663 m; *C. sepimentum*.
Stn DW 1365, S of Viti Levu, 18°12.7'S, 178°32.4'E, 295-302 m, Bouchet, Richer - ORSTOM leg. 15/8/98; *C. dakuwaqa* n. sp.
Stn DW 1376, S of Viti Levu, 18°18.4'S, 178°09.1'E, 497-504 m, Bouchet, Richer - ORSTOM leg. 17/08/'98; *C. fijiense* n. sp., *C. dakuwaqa* n. sp., *C. sepimentum*, *Parastrophia melanesiana* n. sp.
Stn DW 1381, S of Viti Levu, 18°17.8'S, 177°54.4'E, 275-430 m, Bouchet, Richer - ORSTOM leg. 18/8/98; *C. amamiense*, *C.* cf. *campanulatum*, *C.* cf. *cooki*, *C. dakuwaqa* n. sp., *C.* sp. B, *C.* cf. *folini*, *C. inflatum**, *C. japonicum*, *C. maestratii* n. sp., *C. neocaledonicum*, *C. sepimentum**, *C. vertebrale*, *C. virginiae* n. sp., *C.* cf. *fijiense* n. sp., *M. kajiyamai*, *M. legumen*, *M. boucheti*, *Parastrophia megadattilida* n. sp., *Parastrophia* cf. *japonica*, *Parastrophia melanesiana* n. sp.
Stn DW 1384, SE of Viti Levu, 18°18.5'S, 178°05.8'E, 260-305 m, Bouchet, Richer - ORSTOM leg. 18/08/'98; *C. fijiense* n. sp., *C. vertebrale*, *C. neocaledonicum*, *C. dakuwaqa* n. sp., *C. sepimentum*, *Parastrophia* cf. *japonica*, *Parastrophia melanesiana* n. sp.
Stn CP 1325, Bligh Water, 17°16.4'S, 177°49.8'E, 282-322 m, Bouchet, Richer - ORSTOM leg. 07/8/98; *C. neocaledonicum*.
Stn CP 1353, S of Viti Levu; 17°30.9'S, 178°53.3'E, 879-897 m, Bouchet, Richer - ORSTOM leg. 12/8/98; *C. sepimentum*, *C.* cf. *glabellum*.
Stn CP 1354, S of Viti Levu, 17°42.6'S, 178°55.0'E, 959-963 m, Bouchet, Richer - ORSTOM leg. 12/8/98; *C. amamiense*, *C. chinense*, *C. dakuwaqa* n. sp., *C. vertebrale*, *C. inflatum*, *Parastrophia melanesiana* n. sp.
Stn CP 1363, S of Viti Levu, 18°12.4'S, 178°33.0'E, 144-150 m, Bouchet, Richer - ORSTOM leg. 15/8/98; *C. dakuwaqa* n. sp., *C. neocaledonicum*, *Parastrophia* cf. *japonica*, *Parastrophia melanesiana* n. sp.
Stn CP 1366, S of Viti Levu, 18°12.4'S, 178°33.1'E, 149-168 m, Bouchet, Richer - ORSTOM leg. 15/8/98; *C. amamiense*, *C. dakuwaqa* n. sp., *C. lapita* n. sp., *C.* cf. *musorstomi* n. sp., *C. neocaledonicum*, *C. sepimentum*, *Parastrophia* cf. *japonica*, *Parastrophia melanesiana* n. sp.
Stn CP 1369, S of Viti Levu, 18°11.1'S, 178°23.4'E, 392-433 m, Bouchet, Richer - ORSTOM leg. 16/8/98; *C. amamiense*, *C. dakuwaqa* n. sp., *C. neocaledonicum*, *C.* sp. B, *Parastrophia* cf. *japonica*, *Parastrophia melanesiana* n. sp., *C.* sp. A.

Bordau 1, Feb. - Mar. 1999 - Fiji Islands, N/O "Alis" - 1 Station, 1 n. sp. (Tab. 15)

Stn DW 1469, 19°40'S, 178°10'W, Bouchet, Warén & Richer leg. 08/03/1999; *C. bathus* n. sp.

Atelier Lifou 2000 - Loyalty Islands, Lifou, Santal Bay- 31 Stations, 14 sp., of which 4 n. sp. Depth range 2-120 m. (Tab. 16)

Stn 1406, Easo, intertidal areas around boat wharf, hard bottom, 20°48.85'S, 167°07.75' E, 10-13-14/16/18/Nov/2000; *C. neocaledonicum*, *C. sepimentum**.
Stn 1410, between Cape Wekutr and Cape Wajez, edge of the reef flat, 20°56.7'S, 167° 03.1'E, 2-4 m, 25/11/2000; *C. maestratii* n. sp., *C. neocaledonicum*, *C. sepimentum**.
Stn 1412, near Peng, 20°54.2'S, 167° 07.4'E, small soft bottoms, 2-5 m, 14/11/2000; *C.* cf. *glabellum**, *C.* cf. *folini**, *C. neocaledonicum*, *C. vertebrale*.

Stn 1414, near Hunetë, triangular dredge, 4-7 m; *C. sepimentum**.

Stn 1415, near Chépéněhé, sandy, 3-7 m; *C. sepimentum**.

Stn 1419, Gaatcha Bay, 20°55.6'S, 167°04.5'E, slab covered with silt, photophilous algae, 5 m, 10/11/2000; *C. neocaledonicum*.

Stn 1420, Pte de Chépéněhé, 20°47.7'S, 167°09.35'E, slab covered with sediment, 4-5 m, 18-19/11/2000; *C. neocaledonicum*, *C. sepimentum*.

Stn 1421, between Huca Hutighé islet and the coast, coarse sand on slab, 4 m, *C. sepimentum**.

Stn 1422, small cove W of Pte d'Easo, 20°47.1'S, 167°07.4'E, sand of slab, mounds, 4 m, 13/17/25Nov/2000; *C.* cf. *folini*, *C. neocaledonicum*, *C. sepimentum*.

Stn 1423, near Peng, 20°54.0'S, 167°07.3'E, between sandy passages and mounds, 14/11/2000; *C. neocaledonicum*, *C. vertebrale*, *C. sepimentum**.

Stn 1426, Santal Bay, near Hunetë, slab and small pockets of sediment, 4-7 m; *C. sepimentum*.

Stn 1427, near Kiki, 20°47.6'S, 167°10.2'E, coarse sand and living coral at the foot of mounds, 10 m, 25/11/2000; *C. neocaledonicum*, *C. sepimentum**.

Stn 1429, W/SW of Pte d'Easo, 20°47.5'S, 167°07.1'E, coral mounds, sediment passages, 8-18 m, 03/05/23-24/11/2000; *C.* cf. *cooki*, *C. neocaledonicum*, *C. vertebrale*, *C. sepimentum**, *C.* cf. *folini*.

Stn 1430, W/SW of Pte d'Easo, 20°47.5'S, 167°07.1'E, coral mounds, sediment passages, 20-25 m, 09/11/2000; *C.* cf. *folini**, *C. neocaledonicum*, *C. sepimentum*.

Stn 1432, Récif Shelter, 20°53.5'S, 167°02.7'E, coarse sand and eroded coral nodules at the very bottom of the outfall, 12-32 m; *C.* cf. *glabellum**, *C. vertebrale*, *C. sepimentum**.

Stn 1434, near Huca Hutighé islet, 20°52.5'S, 167° 08.1'E, hard bottom, 5-20 m, 06/11/2000; *C.* cf. *cooki*, *C. vertebrale**, *C. sepimentum**.

Stn 1435, Santal Bay, Pointe Lefèvre [=Nem], vertical drop offs and overhangs, 5-30 m; *C. sepimentum**.

Stn 1436, Santal Bay, Gaatcha Bay, coral moundon outfall, 10-20 m, *C. vertebrale*, *C. sepimentum**.

Stn 1442, Cap Aimé Martin (= Acadro), 20°46.4'S, 167°02.0'E, base of outfall, 47 m, 13-14/11/2000; *C.* cf. *cooki*, *C. vertebrale*, *C. sepimentum**, *C. loyaltense* n. sp.

Stn 1444, Baie du Santal, NE of Gaatcha Bay, alternating stony slopes with dead patches and coarse sandy, 9-20 m; *C. vertebrale*, *C. sepimentum*.

Stn 1448, N of Cape Aimé Martin (= Acadro), 20°45.8'S, 167°01.65'E, suction dredge, hard bottom, 20 m, 17/11/2000; *C. vertebrale*, *C. sepimentum*, *C. loyaltense* n. sp.

Stn 1449, N of Cape Aimé Martin (= Acadro), 20°45.8'S, 167°01.65'E, brushings, 17 m, 17/11/2000; *C. vertebrale*, *C. sepimentum**, *Strebloceras kilburni* n. sp., *Strebloceras hinemoa*.

Stn 1450, N of Cape Aimé Martin (= Acadro), 20°45.8'S, 167°01.65'E, brushings, 27-31 m, 17-21/11/2000; *C. neocaledonicum*, *C.* cf. *cooki*, *C. succineum*, *C. vertebrale*, *C. sepimentum**.

Stn 1451, W of Pte d'Easo, 20°47.3'S, 167°06.8'E, between coral mounds, 10-21 m, 19/11/2000; *C.* cf. *cooki*, *C. sepimentum**.

Stn 1453 (in alcohol), between Cape Mandé and Cape Lefèvre (=Nem), 20°54.6'S, 167° 02.1'E, outfall with massive gorgonians, 21-30 m, 22/11/2000; *C. amamiense*, *C. japonicum**, *C. sepimentum**.

Stn 1454, S of Cape Lefèvre (=Nem), 20°56.65'S, 167°02.0'E, shady outfall, 15-18 m, 23/11/2000; *C.* cf. *cooki**, *C. vertebrale**, *C. sepimentum**.

Stn 1455, between Cape Wekutr and Cape Wajez, 20°56.8'S, 167°02.7'E, outfall, 15-20 m, Atelier LIFOU - 25/11/2000; *C. neocaledonicum*, *C. succineum*, *C. sepimentum**.

Stn 1456, NE of Cila bay, outfall, 20°49.3'S, 167°10.4'E, 25-30 m, 24/11/2000; *C.* cf. *folini**, *C. neocaledonicum*, *C.* cf. *cooki*, *C. sepimentum**, *M. rhinoceros* n. sp.

Stn 1457, near Ngoni, 20°46.8'S, 167°02.75'E, overhang and shady blocks, 5-10 m, 27/11/2000; *C. neocaledonicum**, *C.* cf. *cooki*, *C. vertebrale**, *C. sepimentum**.

Stn 1459, Santal Bay, Ngoni beachfront, dredgings, 55-80 m; *C. sepimentum**.

Stn 1462, Santal Bay, Ridge SE of Pointe Aimé Martin (= Acadro), 20°47.1'S, 167°03.2'E, dredgings, 70-120 m, 09/11/2000; *C. sepimentum*, *C. kontiki*.

Norfolk 1, 2001 - New Caledonia S - Norfolk Ridge - Banc P - N/O "Alis" - 1 Station, 1 sp., 1 n. sp. Depth range 266-267 m. (Tab. 17)

Stn DW 1723, 23°18'S, 168°15'E, 266-267 m, Lozouet, Boisselier, IRD leg., 27/06/2001; *C. batlus* n. sp.

Santo Marine Biodiversity Survey, 2006 - Vanuatu Islands - 92 Stations, 22 species, of which 5 n. sp. Depth range 2-121 m. (Tab. 18)

Stn DB 01, NE Tutuba Is., 15°33.1'S, 167°17.8' E, 15-25 m, 10/09/2006; *C. vertebrale**.

Stn DB 08, E Aoré Is., 15°34.6'S, 167°13.8'E, 12 m, 12/09/2006; *C. sepimentum**, *C.* cf. *modestum**, *C. japonicum**, *C. musorstomi* n. sp., *M. kajiyamai*.

Stn DB 12, S Aoré Is., 15°36.6'S, 167°10.1'E, on sand, with dead corals, 10-18 m, 13/09/2006; *C. sepimentum**, *C. japonicum**, *C. musorstomi* n. sp.*, *Parastrophia* cf. *japonica*.

Stn DB 14, Segond Channel, vicinity of Luganville, 15°30.9'S, 167°11'E, muddy sand, 10-14 m, 19/09/2006; *C. sepimentum**, *C. japonicum**, *C. musorstomi* n. sp.*.

Stn DB 16, S Tutuba Is., 15°35.5'S, 167°15.8'E, sand with coral patches, 32-40 m, 14/09/2006; *C. sepimentum**, *C. japonicum**, *C. vertebrale*.

Stn DB 20, NW Urélapa Is., 15°30.5'S, 167°01.4'E, sand with coral patches, 22-25 m, 15/09/2006; *C. sepimentum**; *C. maestratii* n. sp., *C. japonicum**, *C. musorstomi* n. sp., *C. cooki*, *C. vertebrale**, *C. neocaledonicum**, *M. kajiyamai*.

Stn DB 25, Bruat Channel, N coast of Malo Is., 15°37.7'S, 167°11.3'E, sand, 10 m, 16/09/2006; *C. sepimentum**, *C. japonicum**.

Stn DB 29, W Malo Is., 15°38.9'S, 167°05.1'E, sand around coral patches, 15 m, 17/09/2006; *C. sepimentum**, *C. japonicum**, *C. vertebrale*.

Stn DB 33, E Aoré Is., 15°34.7'S, 167°13.8'E, 14-25 m, 18/09/2006; *C. sepimentum*, *C. japonicum**.

Stn DB 40, Palikulo Bay, 15°29.8'S, 167°15.1'E, sand, 5 m, 19/09/2006; *C. sepimentum*, *C.* cf. *modestum**, *C. japonicum**, *C. musorstomi* n. sp., *Parastrophia* cf. *japonica*.

Stn DB 46, Palikulo Bay, 15°28.8'S, 167°15.2'E, sandy flat, 2-3 m, 20/09/2006; *C. sepimentum*; *C.* cf. *modestum**, *C. japonicum**.

Stn DB 53, Palikulo Bay, 15°28.8'S, 167°15.2'E, dead corals, 5 m, 22/09/2006; *C. sepimentum**, *C.* cf. *modestum**, *C. japonicum**, *C. musorstomi* n. sp.*, *C. neocaledonicum**, *Parastrophia* cf. *japonica*.

Stn DB 58, Aésé Is., 15°24.6'S, 167°14.3'E, sand and corals, 6-43 m, 23/09/2006; *C. sepimentum**, *C. japonicum*, *C. vertebrale*.

Stn DB 61, N Tutuba Is., 15°32.3'S, 167°16.9'E, coral reef, 41 m, 25/09/2006; *C. maestratii* n. sp., *C. sepimentum**.

Stn DB 63, SE Aésé Is., 15°26.9'S, 167°15.8'E, sand, dead and live corals, 21 m, 25/09/2006; *C. sepimentum**, *C. japonicum**, *C. vertebrale*.

Stn DB 65, Palikulo Bay, 15°25.8'S, 167°13.0'E, sand and coral patches, 13 m, 26/09/2006; *C. sepimentum**, *C. japonicum**, *C. vertebrale*.

Stn DB 67, W Mavéa Is., 15°22.9'S, 167°13.1'E, sand and dead corals, 7 m, 26/09/2006; *C. sepimentum**, *C. japonicum**, *M. kajiyamai**.

Stn DB 69, Palikulo Bay, 15°24.4'S, 167°13.0'E, 38 m, 27/09/2006; *C. sepimentum**; *C. vanuatorum* n. sp., *C. musorstomi* n. sp., *C. chinense*, *C. neocaledonicum*, *Parastrophia* cf. *japonica*.

Stn DB 71, S Turtle Is. 15°21.6'S, 167°12.5'E, 7 m, 27/09/2006; *C. sepimentum**, *C. japonicum**.

Stn DB 75, SE Matewulu, 15°22.9'S, 167°11.9'E, sand and dead corals, 20 m, 28/09/2006; *C. vanuatorum* n. sp., *C. sepimentum**, *C. japonicum*, *C. neocaledonicum*.

Stn DB 77, Palikulo Bay, 15°27.9'S, 167°14.7'E, sandy, rocky slope, 42-45 m, 29/09/2006; *C. sepimentum**, *C. japonicum**, *Parastrophia* cf. *japonica*.

Stn DB 80, Bruat Channel, 15°37.1'S, 167°07.5'E, sand and corals on submarine hill, 18 m, 02/10/2006; *C. sepimentum**, *C. japonicum**.

Stn DB 83, E Malo Is., 15°43.4'S, 167°15.0'E, flat sand and dead corals, 6 m, 03/10/2006; *C. sepimentum**, *C. japonicum**.

Stn DB 86, NE Malo Is., 15°38.5'S, 167°15.1'E, sand and dead corals, 13 m, 04/10/2006; *C. sepimentum*, *C. japonicum**.

Stn DS 04, Segond Channel, Coolidge wreck, 15°31.4'S, 167°14.1'E, 25 m, 11/09/2006; *C. japonicum*.

Stn DS 10, Aoré Is., 15°36.6'S, 167°10.1'E, sand covered by film of mud, 6-24 m, 12/09/2006; *C. sepimentum**, *C. japonicum*, *C. vertebrale*, *M. kajiyamai*.

Stn DS 18, Segond Channel, Sarakata River mouth, 15°31.3'S, 167°10.4'E, 5-10 m, 14/09/2006; *Parastrophia* cf. *japonica*.

Stn DS 43, Palikulo Bay, 15°27.9'S, 167°14.3'E, sand with coral patches, 22 m, 20/09/2006; *C. sepimentum**, *C. japonicum*, *C. musorstomi* n. sp.

Stn DS 49, W coast of Malo Is., 15°38.7'S, 167°05.2'E, sand & rubble with Cyanophycae, 10-17 m, 21/09/2006; *C. sepimentum*, *C. japonicum**, *M. kajiyamai*.

Stn DS 54, Palikulo Bay, 15°28.8'S, 167°15.2'E, between dead corals and ruins, 5 m, 22/09/2006; *C.* cf. *modestum**, *C. japonicum**, *C. musorstomi* n. sp., *Parastrophia* cf. *japonica*.

Stn DS 91, Segond Channel, Wambu River mouth, 15°33.7'S, 167°08.4'E, 7 m, 06/10/2006; *C. japonicum*.

Stn DS 93, W Tutuba Is., 15°33.6'S, 167°16.5'E, steep slope with rubble and sand, 70 m, 07/10/2006; *C. sepimentum**, *Parastrophia* cf. *japonica*.

Stn DS 96, W Tutuba Is., 15°33.6'S, 167°16.5'E, 114 m, 07/10/2006; *C. sepimentum**.

Stn DS 99, NW Tutuba Is., 15°32.5'S, 167°16.9'E, 100-105 m, 10/10/2006; *C. koutiki*, *C. sepimentum**, *Parastrophia megadattilida* n. sp.

Stn DS 101, N Tutuba Is., 15°32.3'S, 167°17.2'E, 17-19 m, 11/10/2006; *M. kajiyamai**.

Stn DS 102, W Tutuba Is., 15°34.1'S, 167°16.0'E, 98-100 m, 12/10/2006; *C. sepimentum**.

Stn DS 103, W Tutuba Is., 15°34.1'S, 167°16.0'E, 70-80 m, 14/10/2006; *C. japonicum**, *Parastrophia megadattilida* n. sp.*.

Stn DS 104, W Tutuba Is., 15°34.1'S, 167°16.0'E, 80 m, 15/10/2006; *Parastrophia megadattilida* n. sp.

Stn DS 105, NW Tutuba Is., 15°33'S, 167°16.7'E, silty sand in small undercut rock, 92 m, 16/10/2006; *C. sepimentum**, *C. japonicum*, *Parastrophia* cf. *japonica*.

Stn DS 108, NW Tutuba Is., 15°33.2'S, 167°16.6'E, 100 m, 18/10/2006; *C. sepimentum*.

Stn ED 02, Segond Channel, vicinity of Maritime College, 15°31.7'S, 167°09.7'E, 18-21 m, 11/09/2006; *C.* cf. *modestum**.

Stn ED 11, S Segond Channel entrance, 15°35.8/35.9'S, 167°06.7'E, 23-33 m, 15/09/2006; *C. sepimentum**.

Stn ED 17, Segond Channel, vicinity of Maritime College, 15°32'S, 167°09.06'E, 23-27 m, 17/09/2006; *C. japonicum**.

StnEP 01, Segond Channel, 15°32.5'S, 167°09.0'E, 46-47 m, 10/09/2006; *C. sepimentum**, *C. japonicum**.

Stn EP 10, E Aoré Is., 15°34.5/38.0'S, 167°05.1/13.6'E, 45-101 m, 15/09/2006; *C. sepimentum**.

Stn EP 19, NW coast of Malo Is., 15°37.5/38.0'S, 167°05.1/05.6'E, 80-94 m, 19/09/2006; *C. sepimentum*.

Stn EP 21, NW coast of Malo Is., 15°37.7'S, 167°5.2'E, 99 m, 20/09/2006; *C. sepimentum*.

Stn EP 22, NW coast of Malo Is., 15°37.3/37.4'S, 167°05.8/06.0'E, 78-91 m, 21/09/2006; *C. sepimentum**, *C.* cf. *succineum**.

Stn EP 24, W Urélapa Is., 15°36.5'S, 167°00.9/01.7'E, tangle net, 108-121 m, 25/09/2006; *C. sepimentum*, *M. kajiyamai*.

Stn EP 28, NW coast of Malo Is., 15°38'S, 167°05.0'E, tangle net, 90-110 m, 10/10/2006; *C. sepimentum*, *C. japonicum**.

Stn EP 32, off N Urélapa Is., 15°36.6'S, 167°02.0'E, 100 m, 14/10/2006; *C. sepimentum**.

Stn EP 34, Aoré Is., off Aimbué Bay, 15°33.2/33.3S, 167°12.8/12.9E, tangle net, 40-80 m, 14/10/2006; *C. vanuatorum* n. sp., *C. sepimentum**, *C. japonicum**, *C.* cf. *succineum**.

Stn EP 35, Aoré Is., off Aimbué Bay, 15°34.9/35.1'S, 167°13.9/14.1'E, 10-51 m, 15/10/2006; *C. sepimentum**.

Stn EP 36, E Aoré Is., 15°33.1/33.3'S, 167°12.4/12.7'E, 20-60 m, 15/10/2006; *C. sepimentum**, *C. japonicum**, *C.* cf. *succineum**.

Stn EP 37, SW Mavéa Is., 15°23.4/23.6'S, 167°13.1/13.3'E, tangle net, 50-61 m, 16/10/2006; *C. sepimentum**, *C. japonicum**.

Stn EP 38, SW Mavéa Is., 15°23.6/23.7'S, 167°13.3'E, 90-93 m, 16/10/2006; *C. sepimentum**.

Stn EP 39, W Tutuba Is., 15°33.6/33.7'S, 167°16.3/16.5'E, 75-80 m, 17/10/2006; *C. sepimentum**, *C. japonicum**.

Stn ET 14, Segond Channel, vicinity of Maritime College, 15°31.5'S, 167°10.2'E, 23-24 m, 16/09/2006; *C.* cf. *chinense**.

Stn FB 40, Reef near Oyster Is., 15°22.9'S, 167°11.7'E, sandy slope with dead corals, 9 m, 29/09/2006; *C. sepimentum**, *C.* cf. *modestum**, *C. japonicum**, *C. musorstomi* n. sp., *C. neocaledonicum*.

Stn FB 43, Palikulo Bay, 15°28.4'S, 167°14.9'E, massive dead corals, 19 m, 30/09/2006; *C. sepimentum**, *C. vertebrale**.

Stn FB 52, Malokilikili, 15°42.7'S, 167°15.1'E, 7 m, 05/10/2006; *C. sepimentum**, *C. japonicum**, *C. musorstomi* n. sp.*.

Stn FB 56, NE Tangisi Is., 15°35.2'S, 167°02.1'E, 3-18 m, 07/10/2006; *C. sepimentum**, *C. japonicum**.

Stn FB 61, Aoré Is., Port Benier, 15°34.4'S, 167°12.6'E, fine coral sand, 2-3 m, 07/10/2006; *C. sepimentum**, *C.* cf. *modestum*, *C. japonicum**, *C. musorstomi* n. sp.*, *Parastrophia* cf. *cornucopiae*.

Stn FB 64, Tangoa Is., 15°35.4'S, 166°59.2'E, 10/10/2006; *C. sepimentum* *, *C. japonicum**, *C. smriglioi*, *C. maestratii* n. sp.

Stn FB 68, Tangoa Is., 15°35.4'S, 166°59.7'E, massive coral reef, 11 m, 11/10/2006; *C. sepimentum**, *C. japonicum**.

Stn FB 72, Elia Is., 15°36.1'S, 166°58.5'E, sand with dead coral, 16 m, 12/10/2006; *C. sepimentum**, *C. japonicum**, *M. kajiyamai*, *C.* cf. *succineum*.

Stn FB 80, Segond Channel, NW coast of Aoré Is., 15°33.1'S, 167°09.6'E, sand, gravel & dead coral branches, 2 m, 14/10/2006; *C. sepimentum*, *C.* cf. *modestum**, *C. japonicum**.

Stn FB 83, Tutuba Is., 15°32.6'S, 167°17.4'E, coral reef, 8-20 m, 15/10/2006; *C. sepimentum**, *C. amamiense*, *M. kajiyamai*.

Stn FB 90, Segond Channel, SW coast of Aoré Is., 15°35'S, 167°07.7'E, coarse sand, 36-39 m, 16/10/2006; *C. sepimentum**, *C. japonicum**, *C. neocaledonicum*, *C.* cf. *succineum**.

Stn FB 92, Tutuba Is., 15°33.6'S, 167°16.6'E, muddy coral sand, 2-4 m, 14/10/2006; *C. sepimentum*, *C. japonicum**, *C.* cf. *musorstomi* n. sp.

Stn FP 46-49, Aoré Is., Aimbué Bay, 15°32.4'S, 167°12.7'E, 45-50 m, 02-03/10/2006; *C. sepimentum**, *C. japonicum**.

Stn FS 54, Segond Channel, Coolidge wreck, 15°31.4'S, 167°14.1'E, 20-31 m, 05/10/2006; *C. sepimentum*, *C. japonicum**.

Stn FS 74, Strait N Tangoa Is., 15°35.7'S, 166°59.3'E, 12 m, 12/10/2006; *Parastrophia vanuatensis* n. sp.

Stn FS 77, Segond Channel, NW Aoré Is., 15°33.1'S, 167°09.6'E, coral patches on step wall, 29 m, 14/10/2006; *C. sepimentum*, *C. loyaltense* n. sp.

Stn FS 82, Tutuba Is., 15°32.3'S, 167°17.4'E, 8-20 m, 15/10/2006; *C. sepimentum*, *M. kajiyamai*.

Stn FS 84, Tutuba Is., 15°33.6'S, 167°16.6'E, 8-9 m, 15/10/2006; *C. sepimentum*.

Stn LD 09, Malparavu Is., 15°22.2'S, 167°11.3'E, 2-3 m, 29/09/2006; *C.* cf. *modestum**, *C.* cf. *musorstomi* n. sp.

Stn LD 29, Strait of Tangoa Is., 15°35.3'S, 166°59.4'E, brownish mineral sand, 10-12 m, 13/10/2006; *C. inflatum*, *C. sepimentum*, *C.* cf. *modestum*, *C. japonicum*, *C. musorstomi* n. sp., *C. chinense*, *C. neocaledonicum*, *M. kajiyamai*.

Stn LD 30, Segond Channel, vicinity of Maritime College, 15°31.4'S, 167°10.0'E, grey mineral sand, 7-8 m; *C.* cf. *modestum*, *C. varanoi*.
Stn LD 36, W Tutuba Is., 15°33.5'S, 167°16.8'E, 8-10 m, 17/10/2006; *C. sepimentum*.
Stn LS 2, S coast of Santo Is., Belmoul lagoon, 15°35.5'S, 167°06.2'E, 3 m; *C.* cf. *modestum*.
Stn LS 17, Segond Channel, E Sarakata River mouth, 15°31.1'S, 167°10.5'E, mud & sand, 7 m, 04/10/2006; *C. sepimentum*, *C. japonicum**, *C. musorstomi* n. sp.
Stn NB 12, Segond Channel, N Aoré Is., 15°33.1'S, 167°09.6'E, 20 m, 19/09/2006; *C. sepimentum**, *C. japonicum**, *C. musorstomi* n. sp.*, *Parastrophia* cf. *japonica**.
Stn NB 43, S Tutuba Is., 15°36.6'S, 167°16.0'E, 6-30 m, 04/10/2006; *C. sepimentum**, *C. japonicum**.
Stn NS 36, Segond Channel, vicinity of Maritime College, 15°31.7'S, 167°01.5'E, sand with branches of dead corals, 2-3 m, 02/10/2006; *C. vanuatorum* n. sp., *C. japonicum*, *C.* cf. *musorstomi* n. sp.
Stn NS 37, Segond Channel, vicinity of Maritime College, 15°31.4'S, 167°09.8'E, coral reef with sand & mud, 2-3 m, 02/10/2006; *C. sepimentum*, *C.* cf. *modestum**, *C. japonicum*, *C. musorstomi* n. sp., *Parastrophia* cf. *japonica*.
Stn ZB 06, SW Urélapa Is., 15°36.8'S, 167°01.3'E, patches of sand, 30 m, 28/09/2006; *C. sepimentum**, *Parastrophia* cf. *japonica*.
Stn ZB 09, W coast of Malo Is., 15°40.6'S, 167°05.1'E, 5-7 m, 02/09/2006; *C. sepimentum**, *C. japonicum**, *C. vertebrale*, *C.* cf. *succineum*.
Stn ZB 16, Aoré Is., Aimbué Bay, 15°32.4'S, 167°12.1'E, sandy bottom, dead corals & rubble, ca. 5 m, 07/10/2006; *C. sepimentum**, *C. japonicum**, *C. musorstomi* n. sp., *C. neocaledonicum**.
Stn ZB 24, Segond Channel, Coolidge wreck, 15°31.4'S, 167°14.1'E, 26 m, 12/10/2006; *C. japonicum**.
Stn ZM 15, NW Malo, 15°38.1'S, 167°05.9'E, intertidal, 10/10/2006; *C.* cf. *modestum**, *C. japonicum**, *C. vertebrale*, *C.* cf. *succineum*.
Stn ZO 24, Segond Channel, Coolidge wreck, 15°31.4'S, 167°14.1'E, 26 m, 12/10/2006; *C. sepimentum**.

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Example of systematic hierarchy and synonymy:
Family Cardiidae Lamarck, 1809
Subfamily Cardiinae Lamarck, 1809

Genus *Acanthocardia* Gray, 1853
(type species *Cardium aculeatum* Linné, 1758)

Cardium indicum Lamarck, 1819
(Fig. 1A-D, Fig. 2C)

Cardium hians Brocchi, 1814: p. 508, pl. 13, fig. 6 (non Spengler, 1799).
Cardium indicum Lamarck, 1819: p. 4.
Cardium (Cardium) indicum Lamarck – Fischer-Piette, 1977: p. 112, pl. 10, fig. 4 (type).

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Salas C., 1996. Marine Bivalves from off the Southern Iberian Peninsula collected by the Balgim and Fauna 1 expeditions. *Haliotis*, **25**: 33-100.
Grill B. & Zuschin M., 2001. Modern shallow- to deep-water bivalve death assemblages in the Red Sea – ecology and biogeography. *Paleogeography, Paleoclimatology, Paleoecology*, **168**: 75-96.
Boss K.J., 1982. Mollusca, in Parker S.P. (ed.), *Synopsis and Classification of Living Organisms*. Vol. 1. McGraw-Hill, New York: 945-1166.
Carter J.G., Campbell D.C. & Campbell M.R. 2000. Cladistic perspectives on early bivalve evolution, in Harper E.M., Taylor J.D. & Crame J.A. (eds), The Evolutionary Biology of the Bivalvia. *Geological Society, London, Special Publications*, **177**: 47-95.
Vokes H.E., 1980. *Genera of the Bivalvia: a systematic and bibliographic catalogue (revised and update)*. Paleontological Research Institution, Ithaca, Edwards Brothers Inc., 307 pp.

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